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C. A. B.
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Plant Breeding Abstracts

Vol. XXX, No. 3

STATISTICS

2158 HEINISCH, O.
Die Bedeutung der Biometrie für die Landwirtschaftswissenschaften im Allgemeinen und für die Pflanzenzüchtung im Besonderen. **(The importance of biometry for agricultural sciences in general and for plant breeding in particular).**
SB dtsch. Akad. LandwWiss. Berl. 1958 : **7** : No. 14 : Pp. 45.

The following procedures are explained and discussed, with reference to experiments carried out at the plant breeding institutes of the German Academy of Sciences and the University of Leipzig: a ranking test for variance analysis of block experiments; comparison of the mean values of two independent samples using the *t* test, a Wilcoxon test and van der Waerden's *X* test; comparison of the mean values of two samples by pairing individual values using the *t* test, the sign test, Wilcoxon's test and the *G* test; comparison of two samples in respect of their complete distribution (Smirnow test); and evaluating frequency numbers with the help of nomograms. Also problems arising in the determination of correlation are discussed.

2159 WEILING, F.
Die Bedeutung der Transformation für die Versuchsanalyse, insbesondere bei Bonituren mit beliebiger Breite der Bonitursкala. **(The significance of transformation for analysis of experiments, in particular for values with any given range of the scale of values).**
Züchter 1959 : **29** : 281–84.

An example is given of data in a vernalization experiment which could be normalized and subjected to analysis of variance after the application of the probit transformation.

2160 ELANDT, R.
O stosowaniu analizy wariancji. II. Uwagi metodyczne. **(Some remarks on the use of analysis of variance. Part II).**
Roczn. Nauk rol. 1959 : **80** : 171–86.

Various methods providing more accurate treatment than the *F* test are presented. They include the methods of orthogonal squares, the Duncan test, the *d* test and the use of curvilinear regression.

2161 MÜLLER, K.-H.
Vereinfachte Anlagen bei Komplexversuchen. **(Simplified layouts in complex experiments).**
Z. landw. Vers.-UntersuchWes. 1959 : **5** : 5–13.

A layout is described in which the treatments are arranged in strips across each replication. The evaluation of such an experiment is illustrated by means of an example involving four rye varieties and three harvesting times.

2162 BEHRENS, W. U.
Die Auswertung von Feldversuchen nach Mitscherlich. **(The analysis of field trials according to Mitscherlich).**
Z. Acker- u. PflBau. 1959 : **109** : 255–90.

The slide method of Lindhard, a variant of Mitscherlich's adjustment method using differences, Rundfeldt's regression method and another procedure involving the use of balanced block arrangements are analysed. Formulae are derived for estimating error variance and the standard error variance and the standard error of the difference of two treatments.
An investigation was made into the effect on the values for treatment effect and error variance of the assumption that the fertility of the soil depends on the position of the plot according to a quadratic equation; the slide method gave no bias but the other methods involved a slight bias. The regression method and the balanced-block procedure are particularly useful when the graph of plot fertility is a straight line or only a slightly curved portion of a parabola; where the parabola is more curved, it is better to use the slide method.

2163 STRAND, E.
Studies on the efficiency of experimental designs in small grain experiments.
Acta agric. Scand. 1959 : **9** : 321–40.

The efficiency of the following experimental designs was studied in 240 yield trials with small-grain crops at Vollebekk, Norway: randomized design, complete blocks, incomplete blocks, lattice and the row method with check plots. To give an experimental error equal to that of the lattice, the complete block design would

have required 92·9% more plots, the row method calculated with covariance correction 41·0% more and the row method calculated with $b = 1·0$ for correction 58·6% more. In comparisons of the other designs with the row method, the following order of increasing experimental error was obtained: incomplete block with recovery of interblock information; incomplete block without recovery of interblock information; row method with covariance correction; row method with $b = 1·0$ for correction; and completely randomized design. The effect of number of treatments on size of experimental error, studied in the lattice designs, was slight. Experiments with a plot size of 15–20 m². showed the lowest experimental error while the most economical plot size was estimated at 10–12 m². It is noted that the standard deviation and the coefficient of variation were both very significantly correlated with the mean, the first with $r = +0·49$ and $b = +0·056$ and the second with $r = -0·04$ and $b = -0·0016$.

GENETICS

2164 **(Breeding terminology).** Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 194–204. [Japanese].

A list of Japanese technical terms used in plant and animal breeding, with English equivalents, is provided.

Proceedings of the X International Congress of Genetics, McGill University, Montreal, Canada, August 20-27, 1958 : 1 : Pp. 537.

2165 *Demerec, M. Genetic structure of the* Salmonella *chromosome.* (*pp. 55–62*).

Genetic studies on *S. typhimurium* are discussed with special reference to work carried out at the Carnegie Institution of Washington; most of this work has already been reported [cf. XXVII, pp. 594–96, XXVIII, 11 and 2450]*. Fifty-five gene loci have been recognized.

The percentages are given of ultraviolet-stable and ultraviolet-labile alleles showing high reversion frequencies in histidine, proline and serine auxotrophs isolated from strains LT–2 and LT–7. Highly revertible types (spontaneous and induced) were found among the alleles of all the loci studied. The LT–7 strain was found to be heterogeneous with respect to the presence or absence of a factor responsible for the characteristic mutability percentage of the strain, two isolated lines exhibiting the lower percentage characteristic of LT–2.

2166 *Taylor, J. H. The organization and duplication of genetic material.* (*pp. 63–78*).

The use of tritium-labelled thymidine in autoradiographic studies of sister chromatid exchanges in *Bellevalia romana* is described [cf. XXIX, 1237].

On the hypothesis that differences exist between the strands of a duplicating chromosome and that all twin exchanges occur in the first interphase and all single exchanges in the second, the frequency of exchanges will be one twin to two singles. After treatment with colchicine for 2 hr. before thymidine-H^3 was applied, the ratio of twins to singles was very close to the predicted 1 : 2 ratio.

In the second part of the paper the presentation of evidence for the single polynucleotide chain nature of DNA units of chromatids is followed by a discussion of chromosome models and their ability to explain the data on recombination in complex loci.

2167 *Unrau, J. Cytogenetics and wheat breeding.* (*pp. 129–41*).

A short history of wheat breeding is given with special reference to Canada and Sweden.

2168 *Kihara, H. Fertility and morphological variation in the substitution and restoration backcrosses of the hybrids,* Triticum vulgare *x* Aegilops caudata. (*pp. 142–71*).

An account is given of a series of substitution and restoration back crosses continued through nine generations using the reciprocal hybrids of *T. vulgare* ($2n = 42$) and *Ae. caudata* ($2n = 14$); the effects of whole nucleus substitution, chromosome substitution and gene or segmental substitution on fertility and morphology are discussed.

2169 *Jones, D. F. Basic research in plant and animal improvement.* (*pp. 172–76*).

The development of hybrid maize in the United States is briefly described.

2170 *Stubbe, H. Advances and problems of research in mutations in the applied field.* (*pp. 247–60*).

A review is given of some of the achievements in mutation research at the Institute for the Study of Cultivated Plants, German Academy of Sciences, Gatersleben. These relate mainly to work by Scholz on barley [cf. XXIX, 1096, 2626 and 2644], Zacharias on soya beans [cf.

* References in square brackets are to volume and number of entry in *Plant Breeding Abstracts.*

XXVII, 3582], Stubbe on tomatoes [cf. XXVIII, 2349, XXIX, 3228] and Schreiber's studies on the alkaloids in the leaves of *Solanum* and *Lycopersicon* species [cf. XXVII, 1834]. Four *L. pimpinellifolium* mutants, P44/57, P205/57, P213/57 and P216/57, show an increase in tomatin content of more than 100% over control plants. A red mutant of the apple variety Transparent Blanche is also reported.

2171 *Giles, N. H. Mutations at specific loci in* Neurospora. (*pp. 261–79*).

Recent studies on back mutations, relative substrate specificities, gene conversion and interallelic complementation in *Neurospora* are reviewed. Particular attention is given to mutations at the *ad*-4 locus.

2172 *Witkin, E. M. Post-irradiation metabolism and the timing of ultraviolet-induced mutations in bacteria.* (*pp. 280–99*).

An investigation of the sensitive period which follows ultraviolet (UV) irradiation, and during which the genetic consequences of exposure are modifiable, is described. The mutation studied was the change from auxotrophy to prototrophy in a tryptophane-requiring substrain of *Escherichia coli* B/r designated WP2; the post-irradiation treatments involved variations in conditions affecting the rate of protein synthesis. When the timing of the first post-irradiation cell division is altered by varying the dose of UV, the duration of the sensitive period is correspondingly changed; below 1000 ergs per mm^2., the retardation of cell division and the duration of the sensitive period were both found to be proportional to dose. When caffeine was added to the medium the extension of the lag in cell division and the prolongation of the sensitive period were both proportional to concentrations within the range 0·05% and 0·2%. Concentrations of benzimideazole, 2,6-diaminopurine and 5-bromouracil that retard cell division were also found to prolong sensitivity. It is considered that the process terminating the sensitive period (and fixing irreversibly the frequency of mutations) is intimately associated with the synthesis of nucleic acids during the first post-irradiation cell division.

It is suggested that if the yield of induced prototrophs is proportional to the amount of protein synthesized during the sensitive period [cf. XXVII, 3643], and if the duration of the sensitive period is proportional to the dose of UV in the low dose range, then a doubling of the dose in this range will not only double the number of promutants but also double the length of time during which the synthesis of proteins can influence the yield of actual prototrophs obtained. According to this analysis there is a large population of potential mutants induced at low doses that never become prototrophs because the duration of the sensitive period is too short to permit very much protein synthesis. This interpretation would account for the nonlinear relation between mutation frequency and UV dose that is often observed in bacteria. It is noted that caffeine, which extends the sensitive period without itself inducing mutations (in this material), dramatically enhances the mutagenic effect of low doses of ultraviolet radiation.

2173 *Swanson, C. P., Merz, T. & Cohn, N. Metabolism and the stability of chromosomes.* (*pp. 300–05*).

Evidence is assembled suggesting that the chromosome may be considered as a nucleoprotein gel whose state of hydration determines its sensitivity to X rays and chemical mutagens, and whose linear integrity is dependent upon a constant supply of energy.

2174 *Muller, H. J. The mutation theory reexamined.* (*pp. 306–17*).

A discussion of the organization of nuclear material and the evidence from cross influences between strands is developed into a consideration of the validity of the concept of gene mutation. A final section deals with the initiation, stabilization and expression of mutations and the importance of genetic diversity.

2175 *Fincham, J. R. S. The role of chromosomal loci in enzyme formation.* (*pp. 355–63*).

It is argued that, while the *am* locus of *Neurospora* is a significant unit, it corresponds to none of the three kinds of genetic units proposed by Benzer [cf. XXVIII, 1074].

Evidence is assembled in support of (1) the one gene - one protein hypothesis, and (2) the theory that generally "the mutations affecting a single enzyme are at the same locus and mutations affecting different enzymes are at different loci."

2176 *Michaelis, P. Cytoplasmic inheritance and the segregation of plasmagenes.* (*pp. 375–85*).

This review of the author's studies on cytoplasmic inheritance in *Epilobium* is based on the many articles summarized *passim* in *Plant Breeding Abstracts.*

2177 *Clausen, J. Gene systems regulating characters of ecological races and subspecies.* (*pp. 434–43*).

From a discussion of (*a*) the genetic structure of individuals from contrasting natural habitats, (*b*) the gene systems that regulate individual characters of evolutionary significance, and (*c*) the phenotypic expression of certain genes in diverse environments, it is concluded that the evolutionary potential of species is greater than commonly estimated.

2178 *Müntzing, A. A new category of chromosomes.* (*pp. 453–67*).

Recent work dealing with the occurrence, ecological importance, genetic effects, mechanisms of numerical increase, somatic elimination, possible origins and nature of accessory chromosomes is reviewed. Reference is made to unpublished work by (1) Sarvella, who found that the meiotic pairing of the accessories and their nondisjunction in pollen mitosis were less well accomplished in colchicine-induced autotetraploid rye plants than in the corresponding diploids, and (2) Fröst, who has found a mechanism for numerical increase of accessory chromosomes in *Plantago serraria* on the female side.

2179 *Wright, S. Genetics, the gene, and the hierarchy of biological sciences.* (*pp. 475–89*).

As the theme of his presidential address, the author chose the role of genetics in unifying the various branches of biological science.

2180 Hanson, W. D.
Minimum family sizes for the planning of genetic experiments.
Agron. J. 1959 : **51** : 711–15.

Formulae and tables are presented for determining minimum sizes of family for the following: the establishment of the genotypes of a phenotype; a successful back-cross programme; the differentiation between alternative segregation ratios; the choice between alternative hypotheses by sequential testing; the demonstration of linkage between two loci; the analysis of closely linked loci; and the estimation of genetic variances.

2181 Şmalhauzen [Šmal'gauzen], I. I.
Informaţia ereditară şi transformările ei. (**Hereditary information and its transformation**).
An. Romîno-Soviet. : Ser. Biol. 1959 : **13** : No. 2 : 26–30.
[Cf. XXIX, 1163].

2182 Cockerham, C. C.
Partitions of hereditary variance for various genetic models.
Genetics 1959 : **44** : 1141–48.

"General expressions of the partitions (additive, dominance, additive x additive and so on) of variance were given for the additive, multiplicative, and optimum genetic models. Variants of the multiplicative model included the complementary and duplicate factor models as special cases. Some limitations in distinguishing between models from data were discussed. The effect of limiting the total genotypic coefficient of variation for the multiplicative model was investigated." [Author's summary].

2183 Ephrussi, B. S.
(Nucleic and cytoplasmic inheritance).
Izv. Akad. Nauk SSSR (News Acad. Sci. USSR) : Ser. Biol. 1959 : No. 3 : 359–67. [Russian].
[Cf. 55].

2184 Sonneborn, T. M.
The gene and cell differentiation.
Proc. nat. Acad. Sci. USA 1960 : **46** : 149–65.

The text is given of a lecture delivered at a meeting of the National Academy of Sciences of the USA and intended for investigators in all fields of science. Drawing upon a wide range of evidence from multicellular and unicellular organisms, the speaker showed that "there are three main features of the current revolution in the study of cellular differentiation. First, through feed-back mechanisms, it gives to the nucleus, to the chromosomes and genes, a differentially decisive role. Second, it indicates strongly that more goes on in the chromosomes than mere exact reproduction and uniform action of an invariant set of chromosomes. Third, it uses the combined forces of embryology, genetics, cytology, microbiology, biophysics, and biochemistry to attack the basic problems."

2185 Reeves, P.
Role of *Hfr* mutants in F+ x F− crosses in *Escherichia coli* strain K12.
Nature, Lond. 1960 : **185** : 265–66.

Jacob and Wollman [cf. XXVII, 59] suggested that *Hfr* mutants derived from F+ bacteria were the agents in recombination in F+ x F− crosses and that the F− progeny so formed was then secondarily infected by the F+ cells present. Each experiment made by the author to test this theory consisted of two halves. In the first, suspensions of 58–161/F+ (requiring

methionine) and W677/F− (requiring threonine, leucine and aneurin) were mixed in a proportion varying from 1 : 10 to 1 : 100. Aliquots of the mixed suspension were immediately spread over plates of minimal agar + aneurin. Neither parent could grow on this medium and colony counts gave an indication of the recombination rate. In the second half, small numbers of *Hfr* cells derived from 58–161/F+ were added to the mixed suspension before dispensing on to the plates. Colonies were tested for mating type by the negative or positive results of crosses with W677/F− (streptomycin resistant). In two of the experiments, colonies scored as F− were shown not to be chance contaminants by their ability to cross with 58–161/F+ (streptomycin resistant) but not with W677/F− (also resistant). In each experiment addition of *Hfr* cells increased the recombination rate by several times. Most of the progeny in the second part of each experiment, having come from *Hfr* parents, must therefore have originally been F−. The proportion of the F+ progeny in the second half thus provides an indication of the rate of secondary infection. Assuming that the probability of such infection is the same in both halves, the proportions of the zygotes in the first half which were originally F− and F+ may be established. The occurrence of a significant proportion of F+ zygotes in the first half of each experiment makes it evident that recombination in an F+ x F− cross is not mediated entirely by stable *Hfr* mutants of the type so far isolated but that some F+ cells cross directly with F− parents.

2186 Hirota, Y.
The effect of acridine dyes on mating type factors in *Escherichia coli*.
Proc. nat. Acad. Sci. USA 1960 : **46** : 57–64.

Acridine orange converted F+ clones into stable F− forms. The main factors affecting rate of conversion of F+ to F− were the concentration of acridinium ions in the treating medium and the growth of the treated cells in the presence of the dye. Acridine orange increased the frequency of conversion directly, without appreciable selective growth. Conversion from F+ to F− was irreversible. Hfr cells were resistant to the F disinfecting action of acridine orange. This difference in behaviour between F+ and Hfr cells may be explained by assuming that the F determinant has a dual or episomic nature. Conversion of F+ cells may involve loss of a cytoplasmic male determinant, whereas the determinant in Hfr bacteria may be bound to a particular chromosomal site. Proflavine treatment brought about conversion of F+ to F− at lower concentrations than with acridine orange at the same pH. Methylene blue or thionine had no marked activity as regards F disinfection. Propamidine isothionate acted as a weak agent affecting F. [Cf. XXIX, 1002].

2187 Hecht, A.
Growth of pollen tubes of *Oenothera organensis* through otherwise incompatible styles.
Amer. J. Bot. 1960 : **47** : 32–36.

Emerson has reported that pollen tubes of *Oe. organensis* fail to grow from compatible stylar tissue into a graft of stylar tissue containing the same *S* alleles as those present in the pollen tubes. It has therefore been assumed that the incompatibility reaction in this species is equally effective throughout the stigma and style. Results contrary to this finding have been obtained by means of a new technique of culturing and grafting. Styles with attached stigmas were excised and cultured in large Petri dishes. They were then cut, usually 15 mm. below the stigmas, and grafted to styles cut at the same level in a plant belonging to another incompatibility class. The graft was held together by a splint consisting of lactose gelatin and a square of moistened lens paper. In 95 grafts involving a stylar scion having no *S* alleles in common with the pollen and a stock containing the *S* allele of the pollen, tubes grew 22·1 mm. on the average into the stock during a 15-hr. period at 27° C., with some of the tubes growing as far as 55 mm. These results may be interpreted in one of three ways: (1) the incompatibility reaction is stronger in the stigma than in the style; (2) some stimulus is received or some substance is formed during growth of the tubes through compatible tissue; or (3) some of the stylar inhibitory substance was lost by diffusion into the gelatin mixture.

2188 Rizet, G. & Schecroun, J.
Sur les facteurs cytoplasmiques associés au couple de gènes *S–s* chez le *Podospora anserina*. (**On the cytoplasmic factors associated with the gene pair *S-s* in *P. anserina*).**
CR Acad. Sci., Paris 1959 : **249** : 2392–94.

The two alleles *S* and *s* correspond to three strain types, S, s and s^s. S strains are unable to form permanent anastomoses with s strains, apparently because of the action of cytoplasmic factors causing an incompatibility reaction. The cytoplasmic factors of both S and s strains

may pass by anastomosis into s^s strains, with which both are compatible, and by this means each can render the s^s incompatible with the other. The cytoplasmic S factor differs from the s factor in being unable to multiply in s^s strains. The gene *S* occurs in two allelic forms similar in incompatibility reaction, one of which, *S–R*, causes an s^s culture to revert to s after eight days of cytoplasmic contact, while the other, *S–NR*, has no such effect. The cytoplasmic factor S always accompanies the gene *S* even when the latter is transmitted through the microconidia; the cytoplasmic factor s accompanies the gene *s* in s strains but not in s^s strains and is not transmitted through the microconidia. The possible relations between the genes and the cytoplasmic factors are discussed.

2189 Hesin, R. B.
(The role of deoxyribonucleic acids in the transformation processes of bacteria).
An. Romîno-Soviet. : Ser. Biol. 1959 : **13** : No. 2 : 5–25.
[Cf. XXIX, 2157].

2190 Terada, M. & Kondo, I.
Genetic studies on phage DNA mixed infection of purified phage DNA and other active phage particles.
Idengaku Zasshi/Jap. J. Genet. 1959 : **34** : 253–60.
Salmonella gallinarum was subjected to mixed infection with noninfective a_1 phage DNA and an active a_{10s} phage suspension. Phages a_1 and a_{10s} were unrelated serologically. Four new types occurred among the phage progeny from this mixed infection with a frequency of about 10^{-4}–10^{-5}. They belonged to the same serological type as a_{10s} and, like a_{10s}, were capable of producing a plaque on both indicator strains. They all differed, however, from a_{10s} in producing plaques of intermediate size between those of a_1 and a_{10s}. One of the new types resembled a_1 in being capable of lysogenic conversion of *Salmonella* 0(I) antigen. The new types probably resulted from an interaction between the DNA strand injected from intact a_{10s} and the fragment of a_1 DNA which entered the infected cells in some as yet undetermined way. Possibly partial homologies between the DNA of the two phages were involved, or a fragment of a_1 DNA may have been incorporated in a_{10s} progeny particles by a process similar to the incorporation of bacterial DNA into transducing phage.

2191 Jacob, F. & Monod, J.
Gènes de structure et gènes de régulation dans la biosynthèse des protéines.
(Structural and regulatory genes in protein biosynthesis).
CR Acad. Sci., Paris 1959 : **249** : 1282–84.
In wild type *Escherichia coli*, the synthesis of β-galactosidase and galactoside permease is inducible by exogenic galactosides, but constitutive mutants have been found in which the synthesis occurs spontaneously. The mutations occur in a cistron (*i*) which is independent of those governing the structure of the enzyme and the permease. The inducible allele (i^+) is dominant over the constitutive allele (i^-) and governs the formation of a cytoplasmic repressor which inhibits the synthesis of the enzyme and the permease, provided that an exogenic inducer does not remove the inhibition. A similar regulatory gene controlling the production of all the enzymes for tryptophane synthesis has also been detected [cf. 977] and an analogous mechanism governs the ability of the phage genome to enter the phase of vegetative reproduction in lysogenic bacteria [cf. 1000]. These regulatory genes are distinguished from structural genes in that the former are inactivated by mutations which simultaneously affect the synthesis of several proteins, while the latter are concerned with the synthesis of only one protein or peptide sequence. Further, the regulatory genes are unaffected by agents inhibiting protein synthesis. It is noted that, in examples known so far, the structural genes governed by a single regulatory gene are closely linked. It is suggested that the expression of the group of genes is tied to a single structure, termed the operator, governing their activity and sensitive to the repressor and that a mutation in this structure may result in a loss of sensitivity to the repressor. Such mutants would appear as constitutive pleiotropic dominants and would act only on structural genes which are in the *cis* position with respect to the operator in a diploid.

2192 Paris, C. D.
Second generation (F_2) conversion tables.
Phyton, Vicente López 1959 : **13** : No. 1 : 59–61.
Tables of expected ratios for two to six segregating factors for populations of 1 to 999 individuals are provided.

2193 Pritchard, R. H.
Localized negative interference and its bearing on models of gene recombination.
Genet. Res. 1960 : **1** : No. 1 : 1–24.

Evidence relating to localized negative interference in *Aspergillus nidulans* is reviewed and added to and its implications examined [cf. XXV, 2774 and XXVI, 1951]. A value of about 0·4 map unit for mean length of effectively paired segments and a value of about 0·6 for mean frequency of exchange within such segments have been estimated, the segments possessing a variable and possibly random distribution. The data further indicated that frequency of recombination between linked loci is a measure principally of the frequency of effective pairing between them. If, as the evidence suggests, effective pairing is synonymous with homologous contact between chromosomes, it is possible to construct a simple model which is compatible with the view that recombination takes place before the chromosomes are paired in the cytologically observable sense, i.e. before zygotene. The recombinational events occurring within effectively paired regions are generally reciprocal. A single mechanism of recombination of the copy-choice type would however account for the formation of both reciprocal and nonreciprocal recombinants.

2194 Baron, L. S., Carey, W. F. & Spilman, W. M.
Characteristics of a high frequency of recombination (Hfr) strain of *Salmonella typhosa* compatible with *Salmonella*, *Shigella*, and *Escherichia* species.
Proc. nat. Acad. Sci. USA 1959 : **45** : 1752–57.

S. typhosa 'ST–2' behaved as an Hfr donor in phage-mediated recombination with many species of *Salmonella*, *Shigella* and *Escherichia*. It invariably conferred the Hfr capacity on hybrids selected for lactose utilization (*Lac*$^+$); the Hfr factor was therefore linked with *Lac*$^+$ in ST–2. All the *Salmonella*, *Shigella* and *Escherichia* cultures tested with ST–2 were fertile regardless of whether or not they had been classified as F– in matings with *E. coli*. Furthermore, preliminary findings demonstrated that an F^0 strain in an *E. coli* mating may be rendered fertile by the same *E. coli* donor, after hybridization with ST–2. Under appropriate conditions of culture, ST–2 was able to act as an F– recipient when crossed with *E. coli* Hfr. The resulting hybrids retained their ability to mate as Hfr males with *Salmonella*, *Shigella* and *Escherichia*. It was therefore possible to introduce other markers into ST–2 without affecting its Hfr ability.

2195 Tomizawa, J.
Genetic structure of recombinant chromosomes formed after mating in *Escherichia coli*.
Proc. nat. Acad. Sci. USA 1960 : **46** : 91–101.

A bacterial chromosome is assumed to be composed of two units with equivalent genetic information. The units separate during duplication, each unit going to one of the two daughter chromosomes. A recombinant unit could be formed either by direct incorporation of part of the Hfr fragment into a chromosome of an F— cell or by a shift of template from the F— chromosome to the Hfr fragment during formation of the unit. If recombination occurs during duplication of an F– chromosome, at least one of the four units produced must be recombinant. Three models by which these units could combine to form the recombinant chromosomes are considered. The segregation data reported are in agreement with model A, in which two recombinant units are produced which pair to form a homozygous recombinant chromosome.

2196 Iijima, T.
Transfer of a colicinogenic character by protoplast of *Escherichia coli* K-12.
Idengaku Zasshi/Jap. J. Genet. 1959 : **34** : 213–19.

F+ col+ protoplasts transferred their F and colicinogenic characters to F— col— recipient cells. Simultaneous transfer of both characters occurred with a high frequency. Other genetic characters in the recipients were unchanged. F— col+ protoplasts could not transfer colicinogenicity to F— col— or F+ col— cells.

2197 Bodmer, W. F. & Parsons, P. A.
Factorial analysis of balanced four- and higher-point linkage tests.
Heredity 1959 : **13** : 487–98.

The application of factorial analysis to linkage tests introduced in two earlier papers [XXIX, 3383–4] is extended here to four-point and five-point data. It is also explained how confounding can be used to reduce the number of heterozygotes needed. The analysis is exemplified with reference to linkage data on the house mouse; gene interactions appeared to be multiplicative and the logarithmic transformation of the genotype totals was therefore applied.

2198 PERKINS, D. D.
New markers and multiple point linkage data in *Neurospora.*
Genetics 1959 : **44** : 1185–208.

PERKINS, D. D. & CHIYOKO ISHITANI
Linkage data for group III markers in *Neurospora.*
Ibid. 1959 : **44** : 1209–13.

MALING, B.
Linkage data for group IV markers in *Neurospora.*
Ibid. 1959 : **44** : 1215–20.

STRICKLAND, W. N., PERKINS, D. D. & VEATCH, C. C.
Linkage data for group V markers in *Neurospora.*
Ibid. 1959 : **44** : 1221–26.

In the first of the four papers, 53 previously unmapped mutants of *N. crassa* are described, of which at least 25 are at new loci. Data on random segregates obtained by nonselective methods from 75 multiple point crosses have placed 14 of the previously unmapped loci in linkage groups I, II, VI and VII and clarified the sequence of previously known genes. These results, taken together with the new data reported in the remaining three accompanying papers on linkage groups III, IV and V, bring the total number of mapped loci to over 130 and the number of loci in group I to at least 40. All of the mapped loci fall in only nine out of the 14 chromosome arms, a few genes near the centromeres being possible exceptions. Possibly the strikingly uneven distribution of genes is merely a chance result reflecting the position of the markers which happen to have been used for testing linkage. It is also possible that the "empty" arms are genetically inert or that mutations arising in them may be of such a nature that they have not been recoverable as typical markers. Suitable markers close to the centromere however are now available in each group and these should make it now possible to identify any gene loci in the five unmapped arms.

2199 RIFAAT, O. M.
Effect of temperature on crossing-over in *Neurospora crassa.*
Genetica 1959 : **30** : 312–23.

Data on ordered asci from a four-marker cross indicated that *mt* and *arg*–3 were situated on the left arm of the mating-type chromosome, at 10·1 and 7·3 units from the centromere respectively, while on the right arm, *cr* was 9·4 and *me* 17·4 units from the centromere [cf. XVIII, 3660 and XXIX, 3387]. The frequency of crossing over in the region *arg*–3/*cr*, extending across the centromere, increased significantly from 8·4% at 20° and 25° to 18·7% at 30° C. and decreased significantly to 4·2% at 17°. In *cr*/*me*, crossing over was not influenced by temperature. In the region *mt*/*arg*–3, shorter than *cr*/*me* and thus nearer to the centromere, the frequency of crossing over rose significantly from 5·0% at 20° and 25° to 9·9% at 30° and decreased, but not significantly, to 3·3% at 17°. In a three-marker test, with *me* eliminated from the parental cross and *mt*, *arg*–3 and *cr* in essentially the same positions relative to the centromere and to one another as in the four-marker cross, the frequency of crossing over in *arg*–3/*cr* remained unaffected at all temperatures. This contrast with the first test suggests that genetic factors controlling frequency of crossing over are of overriding importance and that the effect of temperature is highly dependent on the genotype.

2200 WILSON, J. Y.
Changes in the distribution of chiasmata in response to experimental factors in the bluebell, *Endymion nonscriptus* (L.) Garcke.
Genetica 1959 : **30** : 417–34.

It is shown that, whether the total number of chiasmata in the chromosomes of the pollen mother cells is increased or decreased, the gain or loss is largely borne by the long arms of chromosomes and by the long chromosomes rather than the short.
Simultaneous change in both differential and interference distances of chiasmata in response to temperature change was observed in this material.

2201 BOWMAN, J. C.
Selection for heterosis.
Anim. Breed. Abstr. 1959 : **27** : 261–73.

A brief review is presented of past and present hypotheses on the genetic basis of heterosis. It is concluded that different mechanisms are responsible for heterosis in different species and crosses. Methods used by plant breeders to exploit heterosis, including recurrent selection, are described and the success achieved with these methods in animal breeding is assessed.

2202 NUJDIN [NUŽDIN], N. I.
Situaţia actuală a teoriei substratului material al eredităţii. **(The present state of the theory of the material substrate of heredity).**
An. Romîno-Soviet. : Ser. Biol. 1958 : **12** : No. 3 : 49–75.

[Cf. XXIX, 68].

2203 Matsushiro, A. & Mizobuchi, K.
Synthesis of the enzyme galactozymase during the transduction by coliphage-λ. (III).
Idengaku Zasshi/Jap. J. Genet. 1959 : **34** : 282–84.

"The enzyme galactose-1-phosphate uridyl transferase, a member of galactozymase, can not be detected in the mutant W 3094 (Gal_4^-) cells of *Escherichia coli* K12. However, it is first detected within 5 minutes after infection with HFT–λ phage under the presence of inducer (galactose), and then the enzyme synthesis continues linearly until about 120 minutes after infection. In this system, therefore, the phenotypic expression appears almost immediately after the introduction of Gal^+ determinant." [Authors' summary].

2204 Pakuła, R., Walczak, W., Fluder, Z. & Zakrzewski, K.
Warunki środowiskowe transformacji dwoinek zapalenia płuc. Rola albuminy.
(Environmental conditions for the transformation of pneumococci. The role of albumin).
Acta microbiol. Polon. 1958 : **7** : 97–104.

Of four serum albumin preparations tested for ability to sensitize pneumococcal cells for transformation to streptomycin resistance, two electrophoretically homogeneous preparations were ineffective but one of the remaining two, containing 8% β-globulin and causing agglutination of *R* pneumococci in a concentration of 0·2%, was effective. This and other observations suggest that *R* agglutinins may be an essential factor in the transformation of *R* pneumococci to streptomycin resistance. This may be true only for pneumococci, since non-hemolytic streptococci were transformed to streptomycin resistance in a medium containing serum-albumin preparations ineffective in transforming pneumococci.

2205 Rupert, C. S.
Photoreactivation of transforming DNA by an enzyme from bakers' yeast.
J. gen. Physiol. 1960 : **43** : 573–95.

Ultraviolet-inactivated transforming DNA derived from *Hemophilus influenzae* recovered its activity when mixed with cell-free extracts of bakers' yeast and exposed to visible light. Various findings were consistent with the assumption that the yeast agent involved was an enzyme. The problem of photoreactivation is discussed from both the biochemical and genetical aspects.

2206 Pakuła, R., Kowalska, J. & Hulanicka, E.
Effect of UV irradiation on the streptomycin-resistance marker in the endocellular and isolated transforming principle.
Bull. Acad. polon. Sci. : Sér. Sci. Biol. 1959 : **7** : 345–51.

Ultraviolet irradiation either of the donor bacterium prior to extraction of DNA or of the DNA alone after extraction caused a marked decrease in transforming efficiency in the donor/receptor combinations *Diplococcus* 'R 36A str'/*Diplococcus* 'R 36A' and *Haemophilus influenzae* 'Rds'/*H. influenzae* 'Rd'; postextraction irradiation had the stronger effect. Much smaller decreases in efficiency were obtained with strain Challies str as donor and *Streptococcus* 'sbe type I/II' as receptor.

2207 Lewis, K. R. & John, B.
A proposed explanation of transmutation by inverted copying.
Phyton, Vicente López 1959 : **13** : No. 1 : 37–43.

It is assumed that some mutations are the result of structural rearrangements and transmutation is explained in terms of inverted copying, with reference to Freese's chromosome model [cf. XXIX, 3347]. This explanation accounts for the production of 6 : 2 and 5 : 3 octads or their tetrad equivalents; if connecting links can be exchanged, 7 : 1 octads are also possible.

2208 Suyama, Y., Munkres, K. D. & Woodward, V. W.
Genetic analyses of the pyr-3 locus of *Neurospora crassa*: the bearing of recombination and gene conversion upon intraallelic linearity.
Genetica 1959 : **30** : 293–311.

An analysis of 32 *pyr*–3 mutants resolved the *pyr*–3 region in linkage group IV into 13 mutational sites arranged linearly. The results favoured the view that most of the prototrophs arose through gene conversion, instead of reciprocal chromosome exchange. It is postulated that conversion was a function of the distance between sites of the *pyr*–3 region, increasing in frequency with increasing distance between sites. In accordance with the suggestion made by St. Lawrence [cf. XXVI, 3045], gene conversion may have been responsible for the negative interference observed in the three-point crosses tested. Complementation was not a prominent feature of the *pyr*–3 mutants, either in intraallelic or interallelic combinations, but they were divisible into at least two

functionally distinct groups which coincided with the genetic mapping of the region. The degree of complementation was not directly related to the location of the sites. Evidence was obtained of "a continuity of additivity between functional groups."

2209 Jinks, J. L.
The genetic basis of "duality" in imperfect fungi.
Heredity 1959 : **13** : 525–28.
From a consideration of the relevant literature and four examples of duality in *Penicillium*, the view is expressed that this phenomenon in the imperfect fungi may have either a nuclear or cytoplasmic basis, a dual colony thus being either a heterocaryon or heteroplasmon.

2210 Scheuer, P. A. G. & Mandel, S. P. H.
An inequality in population genetics.
Heredity 1959 : **13** : 519–24.
It has been shown earlier [XXIX, 3402] that $V' - V \geqslant 0$ for populations in the neighbourhood of polymorphic equilibrium, where V represents the mean viability of the population and V' the mean viability of the next generation obtained by random mating. A mathematical proof is given here that the above inequality holds for all states of the population.

2211 Lewontin, R. C. & Cockerham, C. C.
The goodness-of-fit test for detecting natural selection in random mating populations.
Evolution, NY 1959 : **13** : 561–67.
Given that W_1, W_2 and W_3 are the fitnesses of *BB*, *Bb* and *bb*, the authors consider how far these fitnesses can be estimated from deviations of the zygotic frequencies from the Hardy-Weinberg equilibrium, in particular by testing whether $W_2^2 = W_1 W_3$. A table is given showing the sample sizes necessary to detect selection for various values of W_1 and W_3. When W_1 is the reciprocal of W_3, even intense selection causes no deviation in the zygotic ratios.

2212 Fresco, J. R. & Alberts, B. M.
The accommodation of noncomplementary bases in helical polyribonucleotides and deoxyribonucleic acids.
Proc. nat. Acad. Sci. USA 1960 : **46** : 311–21.
"A quantitative study has been made of the helical complex formation between polyriboadenylic acid or polyuridylic acid and copolymers containing residues common to both members of this complementary pair. The interaction occurs in such a manner that the two-stranded helical complexes formed always contain equal moles of homopolymer residues and complementary residues in the copolymers. This indicates that the noncomplementary residues in the copolymers loop out of the helix. Model building shows that this can be done without altering the essential structural features of the helix, and that loops of one or more residues are feasible. While these loops do weaken the helix, it is apparent that the number of mismatchings which can be tolerated in a DNA-like helix is quite large.
The relevance of these findings to DNA is considered, and hypothetical schemes for the accommodation of point mutations by forming such loops are presented."
[Authors' summary].

2213 Kaplan, R. W.
Gegenwärtige Probleme der Genetik der Mikroorganismen insbesondere der Mutationsforschung. (**Current problems in the genetics of microorganisms, especially mutation research**).
Zbl. Bakt. 1959 : **113** : 9–17.
In this review, evidence that nucleic acids are the chief hereditary material and that most mutations probably take place in the sequence of bases in the nucleic acids is briefly surveyed, and spontaneous mutation and mutagenesis by chemical and physical agents are discussed with special reference to the light thrown on the mechanisms involved by studies of the effects of postmutagenic treatment with heat, light and various chemicals.

2214 Lavallé, R.
Sur un mécanisme moléculaire de mutagénèse par l'acide nitreux. (**On a molecular mechanism for mutagenesis by nitrous acid**).
CR Acad. Sci., Paris 1960 : **250** : 1134–36.
On the assumptions that (1) the structure of DNA is as proposed by Watson and Crick, (2) its replication is of the semiconservative type and (3) genetic information is contained, at least in part, in the sequence of bases in DNA, a mechanism for the known mutagenic action of nitrous acid on DNA is described. It is shown that, in so far as the bases adenine or cytosine are deaminated, the action of nitrous acid on DNA leads necessarily to the substitution of one pair of nucleotides by another at the moment of replication.

2215 Nohe, E.
Mutationszüchtung. **(Mutation breeding).**
Samenfachmann 1959 : No. 18 : 137–44.
This general account deals with the induction of gene mutations and polyploidy.

2216 Iyer, V.
Concentration and isolation of auxotrophic mutants of spore-forming bacteria.
J. Bact. 1960 : **79** : 309–10.
This method makes use of the difference in thermolability of spores and vegetative cells. A spore suspension of *Bacillus subtilis* was subjected to ultraviolet irradiation and introduced into a minimal medium. The spores were incubated at 20° C. until maximum germination had occurred, when the culture was placed in a boiling water bath for a period depending on the strain used; this treatment destroyed the germinated prototrophs. When the cells were spread on a complete medium, a higher proportion of mutants were obtained than is possible with the penicillin method. Since this procedure concentrates mutants which are unable to germinate in a minimal medium, it is important to determine exactly what constitutes a truly minimal medium for the species concerned.

2217 Zamenhof, S.
Effects of heating dry bacteria and spores on their phenotype and genotype.
Proc. nat. Acad. Sci. USA 1960 : **46** : 101–05.
Vegetative cells of *Escherichia coli* and spores of *Bacillus subtilis* which had been dried *in vacuo* were heated at 135°–155° C. for 16 min. The vegetative cells proved to be almost as heat resistant as the spores but differed from the latter by exhibiting pseudoauxotrophy. Sufficient survival for determination of biochemical and other mutants was obtained, the mutant frequencies being 1–10%. Both stable and unstable mutants occurred. The two mutants of *B. subtilis* tested could be transformed by DNA from the wild strain.

2218 Iijima, T.
Artificial *F* elimination in *Escherichia coli* K-12: the effects of acriflavine on *Hfr* strain.
Idengaku Zasshi/Jap. J. Genet. 1959 : **34** : 77–83.
Treatment of Hfr cells with acriflavine induced mutants Hfr— and Hfr—i. A third mutant, type Hfr—i′, appeared as the result of treating Hfr—i with the chemical. Hfr—i, Hfr—i′ and Hfr— respectively resembled F+, Fi and F— types in mating behaviour [cf. XXVIII, 89].

2219 Northrop, J. H.
Studies of the origin of bacterial viruses. VI. Effect of manganese on the proportion of phage-producing, terramycin-resistant, streptomycin-resistant, and phage-resistant cells in lysogenic megatherium cultures.
J. gen. Physiol. 1960 : **43** : 541–50.
The author has previously postulated that the origin and properties of bacterial viruses may be most simply accounted for by assuming that such viruses are a specialized type of transforming principle produced as a result of a mutation of the host cell [cf. XXVIII, 3710 and XXIX, 1209]. Several investigators have reported that $MnCl_2$ has a generalized mutagenic effect. According to the author's hypothesis, this substance may therefore be expected to increase the proportion of phage-producing cells. To test this prediction, *Bacterium megaterium* was treated with $MnCl_2$. Exposure for 10 minutes to 0·004 M at 25° C. resulted in an increase of about ten times in the proportion of the following four types of cell: phage producing and terramycin, streptomycin and phage resistant. The proportion of phage-producing cells reached a maximum in about 4 hr. after treatment, whereas in the case of the other types of mutants the proportion reached a maximum in about 8 hr. At the end of 24 hr., the culture had returned to its original composition. This result confirms the earlier conclusion of the author that the change from normal to phage-producing cells occurs without cell division. In this connexion, it is pointed out that, as reported by Fox [cf. XXIX, 3399], changes of a genetic nature caused by the transforming principle may also take place in the absence of cell division. From a consideration of the calculation of the mutation rate on the basis of various assumptions, the conclusion is reached that it appears preferable to express the results in terms of the experimentally determined ratios rather than as mutation rates. It is doubtful whether the ratios represent equilibrium values.

2220 Iijima, T. & Hagiwara, A.
Mutagenic action of mitomycin C on *Escherichia coli*.
Nature, Lond. 1960 : **185** : 395–96.
Treatment with mitomycin C caused considerable increases in frequency of reversion to

prototrophy. In addition, treatment of the F+ cells raised the recombination rate but the reciprocal treatment of F— cells was ineffective in this respect.

2221 Davis, I.
The survival and mutability of *Escherichia coli* in aqueous solutions of ozone.
Diss. Abstr. 1959 : **20** : LC Card Mic 59–2228 : p. 26. (Abst.).
"Mutation frequencies in the streptomycin-dependence method appear to increase with increasing concentrations of ozone and decreasing survival. In the phage-resistance method, the frequency of zero point mutants showed a significant increase after ozone exposure of the cells. Attempts to isolate ozone-resistant mutants have been without success." The role of hydrogen peroxide in ozone lethality and mutagenesis was also investigated.

2222 Haas, F. L. & Doudney, C. O.
Correlation of loss of photoreversibility of ultra-violet-induced mutations with deoxyribonucleic acid synthesis.
Nature, Lond. 1960 : **185** : 637–38.
Study of reversion to prototrophy in *Escherichia coli* showed loss of photoreversibility of ultraviolet-induced mutation to be closely correlated with postirradiation synthesis of DNA. By the time DNA doubling had occurred, about 80% of the mutations were no longer susceptible to photoreversal. It is thought that this loss in susceptibility is probably due to actual synthesis of the mutated gene. Support is therefore given for the hypothesis that ultraviolet-induced mutation involves DNA synthesis as a final step. [Cf. 1023].

2223 Gauze, G. F., Kočetkova, G. V. & Sorbaeva, N. A.
(The frequency of occurrence of biochemical mutants of staphylococci with impaired oxidation).
Dokl. Akad. Nauk SSSR (Proc. Acad. Sci. USSR) 1960 : **130** : 200–01. [Russian].
Albomycin introduced into the liquid substrate of a *Staphylococcus aureus* strain suppressed its growth without checking the growth of ultraviolet-induced mutants 2 and 21 which were characterized by impaired oxidation. The frequency of mutations was 1·04 to 1·07 in 10^8 cells. No appreciable shift in the frequency of mutations was observed when the initial strain was incubated in a medium containing DNA extracted from the mutant cells.

2224 Witkin, E. M. & Theil, E. C.
The effect of posttreatment with chloramphenicol on various ultraviolet-induced mutations in *Escherichia coli*.
Proc. nat. Acad. Sci. USA 1960 : **46** : 226–31.
The effect of posttreatment with chloramphenicol on the frequency of ultraviolet-induced mutations to (1) streptomycin resistance, (2) streptomycin independence and (3) ability to ferment lactose was determined. The yield of mutations to (3) was markedly and irreversibly reduced by posttreatment with this antibiotic but no appreciable effect on mutation to (1) and (2) was detected. The effect of aminoacid deprivation after irradiation upon mutation to (2) was also investigated. Post treatment did not influence the mutation frequency. It is concluded that mutations to (3), like the majority of mutations to prototrophy, are established only if conditions favour the synthesis of proteins during the so-called sensitive period after irradiation, but that mutations to (1) and (2) have no such requirement, possibly because these alterations may involve losses of genetic material.

2225 Noujdine [Nuždin], N. I.
Les modifications orientées des chromosomes par des greffes entre espèces du genre *Crepis*. (**Directed modifications of chromosomes by grafts between species of the genus *Crepis*).**
Bull. Soc. Sci. Bretagne : Sci. Math. Phys. Nat. 1957 (1958) : **32** : p. 24. (Abst.).
Seeds from grafts between *Crepis capillaris* and *C. tectorum* are said to have given rise to plants whose chromosomes showed amphiplastic modification resembling the modifications observed in sexual hybrids between distantly related species.

2226 Landauer, W.
The phenocopy concept: illusion or reality?
Experientia 1959 : **15** : 409–12.
In this discussion, reference is made to various animal studies. The phenocopy concept is thought to be useful when it refers to experimentally produced variants which are either identical with or very similar to the corresponding mutants and which have, at least in part, a similar path of development.

227 Lîsenko [Lysenko], T. D.
Pentru materialism in biologie. (**For materialism in biology**).
An. Romîno-Soviet. : Ser. Biol. 1959 : **12** : No. 1 : 5–33.
[Cf. XXVIII, 3723].

2228 Veresin, M. M. & Maškin, S. I.
(**The fruits of a great idea. On the occasion of the 100th anniversary of C. Darwin's book "The origin of species"**).
Les. Hoz. (Forestry) 1959 : No. 12 : 25–30. [Russian].
This review of Russian research in biology since Darwin mentions Mičurin-Lysenko genetics and Oparin's studies on the origin of life as among the major achievements.

2229 Vlasjuk, P. A. & Poruckij, G. V.
(**The characteristics of nucleic-acid metabolism and changes in the vitality of plants**).
Agrobiologija (Agrobiology) 1959 : No. 2 : 177–83. [Russian].
Feeding of the roots of wheat, maize and lupin with P^{32}, thiamin and other substances caused quantitative and qualitative changes in the nucleic-acid metabolism of the plants and increased their vitality and productiveness. It is thought that this evidence conflicts with the views of those biologists who regard nucleic-acid metabolism as autonomous and independent of environment.

EVOLUTION

2230 Plochmann, G. K.
Darwin or Spencer ?
Science 1960 : **130** : 1452–56.
Reasons are given for the relative unimportance of Spencer's biological views in the history of science, compared with those of Darwin.

2231 Stauffer, R. C.
"On the origin of species": an unpublished version.
Science 1959 : **130** : 1449–52.
The author gives an account of the third version of Darwin's theory which was entitled *Natural selection* and which was to be a full-scale treatment of evolution. Darwin did not finish this version because, in view of the receipt of Wallace's sketch of his own theory of natural selection early in 1858, he felt obliged to write an abstract which could be published the following year, as the first edition *On the origin of species*. The author draws attention to Darwin's use of Linnaean ecological concepts, as well as to the possible repercussions of Darwin's theory of evolution, had he been able to publish it in the form originally intended.

2232 **Charles Darwin.**
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1959 : **32** : 1583–84.
A brief tribute is paid to Darwin's studies on evolution which are said to have contributed towards a materialistic and dialectical understanding of nature. Mičurin's work is also mentioned.

2233 Tutin, T. G.
Centenary of "The Origin of Species".
Nature, Lond. 1960 : **185** : 216–17.
An account is given of the proceedings of the conference which was arranged by the Botanical Society of the British Isles to celebrate the above centenary and held during November 1959.

2234 Schäller, G.
Natürliche Zuchtwahl und Pflanzenzüchtung—ein Beitrag zum Darwin-Gedächtnisjahr. (**Natural selection and plant breeding, a contribution to the Darwin commemoration year**).
Dtsch. Gartenbau 1959 : **6** : 276–78.
Darwin's theory of natural selection is briefly explained and its effect on breeding discussed.

2235 Matoušková, B. & Matoušek, O.
(**Darwinism in Czechoslovakia**).
Ann. Biol./Ann. Biol., Moskva 1959 : **1** : 35–52. [Russian].
This historical outline of Darwinism in Czechoslovakia mentions Gregor Mendel both as a student and critic of evolutionary theory.

2236 Timofeev-Resovski [Timofeev-Resovskij], N. V.
Microevoluţia, fenomenele elementare, materialele şi factorii procesului de microevoluţie. (**Microevolution, elementary phenomena, material and factors of the process of microevolution**).
An. Romîno-Soviet. : Ser. Biol. 1959 : **12** : No. 1 : 102–21.
[Cf. XXVIII, 3733].

2237 Tolmačev, A. I.
(**The centenary of "The Origin of Species" by Charles Darwin**).
Bot. Ž. (Bot. J.), Moskva 1959 : **44** : 1525–37. [Russian].
The writer sees the major contribution of Darwin as the presentation of an acceptable mechanism for evolution in the form of selection.

The experimental evidence of the efficacy of the process left, and still leaves, much to be desired. The nature of hereditary variation remained obscure to Darwin and was elucidated only later by geneticists; the degree to which acquired characters are inherited remains, it is affirmed, one of the basic problems of biology and much more concrete experimentation in this field is required. We are as far as ever from a true natural system of taxonomy based on a knowledge of phylogeny and more attention needs to be given to historical considerations in studies of phytogeography.

2238 Sobol', S. L.
(The evolutionary concept of Charles Darwin in the early stages of its inception).
Ann. Biol./Ann. Biol., Moskva 1959 : **1** : 13–34. [Russian].

The commencement of the principal ideas of Darwin's evolutionary theory is traced back to 1838 and even to 1833, before Darwin had had an opportunity to read Malthus's "Essay on population".

2239 Kanaev, I. I.
(The basic features of G. Buffon's evolutionary concept).
Ann. Biol./Ann. Biol., Moskva 1959 : **1** : 265–86. [Russian].

An outline of Buffon's evolutionary ideas is given.

2240 Mikulinskij, S. R.
(The views of K. M. Baer on evolution in the pre-Darwinian period).
Ann. Biol./Ann. Biol., Moskva 1959 : **1** : 287–362. [Russian].

Progressive changes in Baer's ideas on evolution are described.

2241 Baer, K.
(Unpublished manuscripts).
Ann. Biol./Ann. Biol., Moskva 1959 : **1** : 363–409. [Russian].

As a supplement to the preceding article [cf. 2240] Russian translations of the following hitherto unpublished papers by Baer are appended: Artificial and natural classifications of animals and plants; Evolution of life on earth; and Kinship in animals.

2242 Matveev, B. S.
(Embryonic similarity and the theory of recapitulations in the light of Darwin's theory).
Uspehi Sovrem. Biol. (Advanc. in Mod. Biol.) 1959 : **48** : 279–91. [Russian].

The following conclusions emerge from this review. (1) Similarity in embryonic ontogeny of the progeny reflects the static element of ancestral development which has not been upset by environmental adaptation. (2) Recapitulation indicates the mode of change in the ancestral form as affected by divergent evolution of the progeny and thus represents phylogenetic evolution as a series of successive generations of ontogenesis.

2243 Olenov, Ju. M.
(The role of spatial isolation in the origin of species).
Uspehi Sovrem. Biol. (Advanc. in Mod. Biol.) 1959 : **48** : 329–42. [Russian].

Spatial isolation is believed to operate in the following ways. It restricts immigrations from other areas where natural selection proceeds along different lines and thereby safeguards the continuity of selection in the same direction within a given area. This results in a sharp increase of the efficacy of selection and provides conditions for intense evolution of new races and species.

2244 Pop, E.
(The growth of Darwinism in Rumania).
Ann. Biol./Ann. Biol., Moskva 1959 : **1** : 53–62. [Russian].

It is shown that Darwinism gained ground slowly in Rumania until it was finally accepted after 1899.

2245 Nuždin, N. I.
(Lamarck, Darwin and modern biology).
Uspehi Sovrem. Biol. (Advanc. in Mod. Biol.) 1959 : **48** : 245–66. [Russian].

This review of research by Soviet and western geneticists deals with opposing concepts of evolution, heredity, directed changes, inheritance of acquired characters and other related subjects. The validity of Mičurin-Lysenko theories on directed changes and inheritance of acquired characters is upheld. In particular, mention is made of A. Durrant's researches on environmentally induced inherited changes in flax [cf. XXIX, 973].

2246 Pavlovskij, E. N.
(Darwin and his theory. On the occasion of the centenary of the publication of C. Darwin's book "The origin of species by means of natural selection").
Priroda (Nature), Leningrad 1959 : No. 12 : 7–12. [Russian].

The significance of evolutionary theory to modern biology is acclaimed despite "the

uncritical acceptance" of Malthusian ideas by Darwin and what is regarded as misinterpretations of his theory by De Vries, Bateson, Weismann, Morgan and Lotsy. Darwinism has provided the foundation for the Mičurinist theory on directing heritable changes in plants and animals.

2247 Giljarov, M. S.
(The problems of modern ecology and the theory of natural selection).
Uspehi Sovrem. Biol. (Advanc. in Mod. Biol.) 1959 : **48** : 267–78. [Russian].
Research on the effects of natural selection in biogeocenoses is reviewed.

2248 Rashevsky, N.
A note on the nature and origin of life.
Bull. math. Biophys. 1959 : **21** : 185–93.
"Some relational aspects of the property of self-reproduction of biological systems are studied. If in addition to the requirement of the property of self-reproduction we add also the requirement of adaptability of the organism to changing environment, this imposes certain conditions on the topology of the graphs which represent such systems. A further study of the relational properties of such systems seems to offer the possibility of deriving the principle of biological mapping from the requirement of self reproduction and adaptability.
"An examination of the problem of the original formation of such self-reproducing systems in connection with the established fact of impossibility of spontaneous generation leads to the conclusion that an organism must inhibit such processes which, in the absence of organisms would lead to spontaneous generation."
[Author's summary].

2249 Oparin, A. I.
Stadiul actual al problemei originii vieţii. **(The present position of the problem of the origin of life).**
An. Romîno-Soviet. : Ser. Biol. 1958 : **12** : No. 2 : 5–21.
[Cf. XXVIII, 2567].

CYTOLOGY

2250 Jukov-Verejnikov [Žukov-Verežnikov], N. N., Pehov, A. P. & Lîsogorov [Lysogorov], N. V.
Legile biologice şi fizicochemice ale eredităţii. **(The biological and physicochemical laws of heredity).**
An. Romîno-Soviet. : Ser. Biol. 1959 : **12** : No. 1 : 34–47.
[Cf. XXIX, 118].

2251 Vasileva-Drjanovska, O. A. & Nikolov, H.
(Cytochemical and cytological characteristics of microspores and macrospores in *Phaseolus*).
Izv. bot. Inst. (Bull. bot. Inst.), Sofija 1956 : **5** : 346–57. [Russian].
The nucleic-acid cycle and the formation *de novo* of chromosomes at meiosis I and II of *Phaseolus* are described. The processes of synthesis of DNA and RNA are separate though they coincide in time. The cycles of synthesis of DNA and RNA are associated with the formation of new nuclei and cells. As soon as DNA and RNA are used up in the formation of new nuclei and cells they are synthesized again by the newly formed cells. After fixation with OsO_4, at the leptotene and diplotene stages of meiosis no chromosomes were observed. However, after fixation with Carnoy's fluid or alcohol, an achromatic thread appears at the leptotene stage. This suggests that the thread bears no relation to the chromosomes. DNA is known to be a component part of the chromosomes, but the thread contains no DNA. The chromosomes arise and develop first in prophase I.

2252 Doudney, C. O.
Inhibition of nucleic acid synthesis by chloramphenicol in synchronized cultures of *Escherichia coli*.
J. Bact. 1960 : **79** : 122–24.
"Following synchronization of cellular division in *Escherichia coli* strain WP2 by cold treatment techniques, addition of chloramphenicol during a short period of time upon incubation of the culture at 37C blocks nucleic acid synthesis. With subsequent incubation chloramphenicol addition has little effect on nucleic acid synthesis until the first cellular division. Chloramphenicol blocks DNA synthesis when added just prior to cellular division whereas the addition of chloramphenicol during a short period of time subsequent to cellular division blocks RNA synthesis. It is suggested that the appearance of new proteins at specific times related to cellular division are requisite to subsequent nucleic acid synthesis."
[Author's summary].

2253 Lima-de-Faria, A.
Bibliography on autoradiography with special reference to tritium labeled DNA precursors.
Hereditas, Lund 1959 : **45** : 632–48.
In an introductory note attention is drawn to

the value of autoradiography in elucidating chromosome organization and in other fields of enquiry and also to problems arising through limitations of the technique. The bibliography lists papers on both animals and plants and includes those dealing with a wide range of technical aspects.

2254 Gay, H.
Nuclear control of the cell.
Sci. Amer. 1960 : **202** : 126–36.

A popular account is given of electron-microscopic observations on *Drosophila* at the Department of Genetics of the Carnegie Institution of Washington, providing evidence of transfer of material from the salivary-gland chromosome to the cytoplasm, by way of vesicles in the nuclear membrane [cf. XXVII, 3651]. In some cases the chromosomal extension in the vesicle may be traced to a highly heterochromatic region. Biochemical tests have shown that the vesicles contain both DNA and RNA. The transfer detected in *Drosophila* may possibly be envisaged as essentially one by which the nuclei in all cells exert control over cytoplasmic activity. Since such a process involves transfer of molecular particles, it would not ordinarily be visible, even in electron micrographs. In *Drosophila*, however, the process is highly adapted to the production of large quantities of protein in a short time, in the secretion of a substance for pupal attachment. As a general hypothesis, it is speculated that a particular chromosomal region, characterized by the composition of its DNA and associated RNA, confers its specificity upon the section of nuclear membrane forming the vesicle and released into the cytoplasm, where the section of membrane becomes a carrier of a particular type of RNA with the function of directing the synthesis of a specific protein.

2255 Sueoka, N.
Mitotic replication of deoxyribonucleic acid in *Chlamydomonas reinhardi*.
Proc. nat. Acad. Sci. USA 1960 : **46** : 83–91.

Using the density gradient centrifugation technique in experiments involving transfer from an N^{15} to an N^{14} medium, DNA replication in mitosis in *Ch. reinhardi* could be interpreted according to the model proposed by Watson and Crick.

2256 Steffensen, D. & Bergeron, J. A.
Autoradiographs of pollen tube nuclei with calcium-45.
J. biophys. biochem. Cyt. 1959 : **6** : 339–42.

Ca^{45}-labelled pollen of *Lilium longiflorum* was allowed to develop into pollen tubes between 5 and 6 cm. long in the styles of nonlabelled flowers. The tube nucleus and the two ♂ nuclei all retained Ca^{45} after this period of growth and development. It was therefore inferred that the calcium was bound in a stable component, probably DNA, in the chromosomes.

2257 Shaw, G. W.
The nature of differential reactivity in the heterochromatin of *Trillium* and *Paris* spp.
Cytologia, Tokyo 1959 : **24** : 50–61.

The degree of differentiation of heterochromatic segments after cold treatment varied from one species to another and within some species from one segment to another. The heterochromatic segments lost their differentiation when the chilled chromosomes were blocked at metaphase by colchicine treatment and then subjected to normal temperature. This loss of differentiation is explained by assuming that DNA was synthesized by the heterochromatic segments, which are regarded as retaining the early-prophase condition. Differential reactivity was identical in polyploid forms and their diploid counterpart. Various chemical treatments, applied to *Trillium* spp., failed to reveal heterochromatic segments. Possibly these treatments were nonspecific for heterochromatin. As shown by the author's observations on *T. undulatum* (B chromosomes) and cases reported by other investigators, differentiation into heterochromatic segments may occur in untreated material. Furthermore, if the DNA content is sufficiently high as in the interphase nuclei of roots emerging from *Trillium* rhizomes at the beginning of the growing season, cold treatment may fail to induce DNA starvation and consequent differentiation at metaphase.

2258 Satô, D.
The protokaryotype and phylogeny in plants.
Sci. Pap. Coll. gen. Educ. Univ. Tokyo (Biol. Part) 1959 : **9** : 303–27.

A brief account is given of the putative course of evolution of the plant caryotype from a hypothetical protocaryotype of $n = 2$. The recently discovered bryophyte *Takakia lepidozioides* ($n = 4$) is regarded as representing an early stage in caryotype evolution. A table is

given of chromosome numbers in all the major plant phyla except the angiosperms.

2259 Snow, R.
Chromosome numbers of California plants, with notes on some cases of cytological interest.
Madroño, S. Francisco 1959 : **15** : 81–89.

In addition to listing chromosome counts of a number of Californian plants, it is reported that (1) *Isomeris arborea* is not a haploid but a diploid with small, difficultly staining chromosomes, and (2) *Lupinus superbus* var. *elongatus* has a large so-called A bivalent with unequally sized chromosomes.

2260 Mehler, A. H. & Prévost, G.
Perte d'une fonction enzymatique essentielle à la suite de l'élimination d'un type nucléaire d'un mycélium dicaryotique de coprin. (**Loss of an essential enzymatic function following the elimination of a nuclear type from a dicaryotic mycelium of *Coprinus*.**)
CR Acad. Sci., Paris 1960 : **250** : 588–90.

When two uracil-requiring lines of *C. fimetarius*, one carrying *ur*4 and the other *ur*7 but otherwise isogenic, were combined, the dicaryotic mycelium obtained grew as quickly in the absence of uracil as that from *ur*4$^+$ x *ur*7$^+$. On fragmentation of the dicaryotic mycelium, monocaryons able to grow in the absence of uracil were obtained from the combinations *ur*4 x *ur*7$^+$ and *ur*4$^+$ x *ur*7$^+$ but not from *ur*4 x *ur*7; none of the dicaryons obtained by fragmentation required uracil. It is concluded that the ability to form the requisite enzyme is conferred by nuclear material and that the cytoplasm does not have this property.

2261 Kusanagi, A. & Tanaka, N.
Cytological studies on *Luzula* chromosome. I. The centromere problem.
Idengaku Zasshi/Jap. J. Genet. 1959 : **34** : 169–73.

Using cadmium chloride solution and acetic alcohol for fixation, the authors found the chromosomes of *L. purpurea* to be dicentric.

2262 Chardard, R.
L'ultrastructure des chromosomes prophasiques méiotiques de quelques orchidées. (**The ultrastructure of the meiotic prophase chromosomes of some orchids**).
CR Acad. Sci., Paris 1959 : **249** : 1386–88.

By means of electron microscopy, meiotic prophase chromosomes in the pollen mother cells of various orchids have been seen to have a densely osmiophilic core surrounded by less densely staining material. Sometimes these structures are double and appear to correspond with the chromosomal core or synaptinemal complex hitherto described only for animal cells.

2263 Bajer, A.
Change of length and volume of mitotic chromosomes in living cells.
Hereditas, Lund 1959 : **45** : 579–96.

By means of time-lapse cine-micrography, measurements were made on chromosomes in flattened endosperm cells, comprising three normal cells and one cell dividing under the influence of colchicine in *Haemanthus katharinae* and one normal cell in *Leucojum aestivum* [cf. XXIX, 932, 1244]. The chromosomes began to decrease in length before the dissolution of the nuclear membrane and continued to do so until metaphase. Just before onset of anaphase, shortening began again and continued until anaphase was completed. The pattern of contraction during c-mitosis was not markedly different from that in normal mitosis, except for the strong contraction at c-prophase. Slight differences were detectable between homologous chromosomes in different cells, or even in the same cell, with respect to length at corresponding stages and the course of changes in length. Volume was calculated from measurements of length and breadth on the assumption that chromosomes are circular in cross section. Volume increased until late metaphase, when it attained a maximum, and then decreased during the whole of anaphase. Various factors which may be responsible for changes in chromosome length and volume are discussed.

2264 Lima-de-Faria, A., Sarvella, P. & Morris, R.
Different chromomere numbers at meiosis and mitosis in *Ornithogalum*.
Hereditas, Lund 1959 : **45** : 467–80.

As already briefly reported [cf. XXIX, 1043], study of *O. virens* ($n = 3$) has shown chromosome length and chromomere number to be about five times higher at (1) pachytene and (2) prophase of the second pollen mitosis in the case of each member of the complement. Average distance between two consecutive chromomeres was about 1 micron at both stages. Distance between chromomeres was also found to be of the order of 1 micron in four other species, viz. *Agapanthus umbellatus*, *Secale cereale*, *Lycopersicon esculentum* and *Salvia horminum*. Possibly this constancy in chromomere distance is merely the microscopic

expression of a periodicity imposed by the length or constitution of the DNA molecule. At (1) chromosome II in *O. virens* has a large heterochromatic knob which at (2) is very small and sometimes difficult to distinguish. Chromosome I, with no knob or any other chromomeres at (1), shows two large positively heteropycnotic segments at diacinesis and metaphase I but lacks this differentiation into heteropycnotic segments at metaphase of mitosis in root tips. Morphological variation in the knob region, differential behaviour of the heteropycnotic regions and difference in chromomere number provide evidence that the same segments of a particular chromosome are organized in dissimilar ways in different tissues. These findings have direct bearing on the problem of gene activity at different stages of development. If the supposition that chromomeres are tightly spiralized is accepted, different chromomere numbers represent a differential spiralization along the chromosome. Single chromomeres, as opposed to interchromomere regions, represent sites where the genes are "more concealed in their activity. By differential spiralization along the chromosome body in different tissues different genes would get exposed or concealed at different stages of development."

2265 Yuasa, A. & Kawada, R.
The effect of K-ion on the matrix of the chromosome.
Sci. Pap. Coll. gen. Educ. Univ. Tokyo (Biol. Part) 1959 : **9** : 229–33.

Further to an earlier study [XXIV, 807], the authors report that pretreatment with 0·1% KOH, KCl or NaOH followed by acetocarmine staining is an effective method of revealing the chromonemata of *Tradescantia virginiana*. It is thought that these substances cause the chromosome matrix to swell and disrupt. Pretreatment with sucrose solution was similarly effective but in this case the differentiation of the chromonemata is thought to result from an increased divergence in the refractive indices of the chromonemata and matrix.

2266 Satô, S.
Electron microscope studies on the mitotic figure. II. Phragmoplast and cell plate.
Cytologia, Tokyo 1959 : **24** : 98–106.

Electron-microscopic observations on the phragmoplast and cell plate in PMCs of *Lilium longiflorum* and *L. lancifolium* are reported [cf. XXIX, 3475]. The phragmoplast is described as consisting of innumerable parallel fibrils lying at right angles to its equatorial plane and of fluid substances in the interfibrillar spaces. The cell plate first appeared as two parallel lamellae composed of single fibrils at right angles to those of the phragmoplast. The cell plate developed centrifugally in the phragmoplast along its equatorial plane. When the cell plate had reached the wall of the mother cell, cell-wall forming substances from this wall diffused into the space between the two lamellae, a single cell membrane thus being formed. Hardening of the daughter cell wall took place centripetally.

2267 Porter, K. R. & Machado, R. D.
Studies on the endoplasmic reticulum. IV. Its form and distribution during mitosis in cells of onion root tip.
J. biophys. biochem. Cyt. 1960 : **7** : 167–80.

Observations are reported on the distribution and behaviour of the endoplasmic reticulum during mitosis in cells of onion and garlic root tips examined under the electron and phase-contrast microscopes.

2268 Garrigues, R.
Action de quelques sels de beryllium sur les cellules végétales. (**Action of some beryllium salts on plant cells**).
CR Acad. Sci., Paris 1959 : **249** : 2614–16.

The nitrate and chlorate of beryllium in 10% aqueous solutions inhibit growth and cause mitotic abnormalities in root tips of *Vicia faba*. A saturated solution of the carbonate has a similar but less rapid effect and tends to give rise to endopolyploidy.

2269 Deysson, G. & Rollen, A.
Action de deux dérivés de l'isonicotylhydrazide (pasiniazide et sulfoniazide) sur la division des cellules végétales. [**Action of two derivatives of isonicotyl hydrazide (pasiniazide and sulphoniazide) on plant cell division**].
Ann. pharm. franç. 1958 : **16** : 314–26.

The above compounds both have an inhibitory effect upon root-tip mitosis in *Allium sativum*, preventing the development of stages beyond prophase and causing prophase cells to return to the resting state. With the pasiniazide, a compound of isonicotinic hydrazide and p-aminosalicylic acid, the magnitude of the effect corresponds to that of the isonicotinic hydrazide component. With the second substance, a condensation product of isonicotinic hydrazide with benzaldehyde-m-sulphonic acid, the effect is less than would be produced by a corresponding amount of isonicotinic hydrazide.

2270 Deysson, G. & Truhaut, R.
Étude de l'activité antimitotique du NN′N″ triéthylène-thiophosphoramide sur les cellules végétales. (**Study of the antimitotic action of NN′N″-triethylene thiophosphoramide on plant cells**).
CR Soc. Biol., Paris 1959 : **153** : 1499–503.
The following observations on the effects of the above compound on root tips of *Allium sativum* are reported. At concentrations of $2{\cdot}89 \times 10^{-7}$ M and above, complete inhibition of mitosis was induced after 24–72 hr., the length of the period depending upon the concentration. Mitodepression accompanied by pycnosis was found after 4 hr. at the highest concentration, $5{\cdot}78 \times 10^{-5}$ M, and mitodepression and chromosome fragmentation after longer periods at the lower concentrations.

2271 Vazart, J.
Les divers types d'association chromosomique au cours de la prophase méiotique. (**The different types of chromosome association occurring during meiotic prophase**).
CR Acad. Sci. Paris 1959 : **249** : 2608–10
In addition to primary associations at zygotene between homologous chromosomes or portions of chromosomes and secondary associations between nonhomologous chromosomes immediately prior to metaphase, a third type, designated supplementary association, is described. Supplementary associations, first observed in *Impatiens* and some Umbelliferous species and later detected also in other families, are like secondary associations in that they do not affect the normal progress of meiosis, but are unlike them in that they begin at synapsis, continue up to diacinesis and show fine chromatic strands joining the associated chromosomes. The multivalent associations arising at zygotene may give rise to figures showing partner exchange between the paired chromosomes at pachytene. It is thought that these supplementary associations occur between partially homologous chromosomes resulting from long established polyploidy in the species studied. Anaphase distribution is normal, but in the daughter cells each chromosome maintains its association with what was previously a neighbouring bivalent, so that each daughter cell shows half the number of interchromosomal links that occurred at prophase; the association is finally loosened during the interphase separating the two meiotic divisions. It is suggested that study of the phenomenon described may be of use in tracing evolutionary relationships within families.

2272 Vasil, I. K.
Cultivation of excised anthers *in vitro*—effect of nucleic acids.
J. exp. Bot. 1959 : **10** : 399–408.
A fuller account is provided of investigations which have already been reported [cf. XXIX, 3477].

2273 Mühlenberg, C. E. & Naumann, L.
Observaciones sobre cambios cromosómicos estructurales en *Matthiola incana* R. Br. (**Observations on structural chromosome changes in *M. incana* R. Br.**).
Rev. Fac. Agron. La Plata 1958 : **35** : 39–45.
Observations on pollen sterility and chromosome aberrations in 26 families suggest that the material studied shows a genotypically controlled tendency to produce new structural chromosome changes. It was also observed that pollen sterility was appreciably lower than would have been expected from the frequency of chromosome rings, bridges and univalents.

2274 Savage, J. R. K., Neary, G. J. & Evans, H. J.
The rejoining time of chromatid breaks induced by gamma radiation in *Vicia faba* root tips at 3° C.
J. biophys. biochem. Cyt. 1960 : **7** : 79–85.
"The observation was made previously that the reduction in radiosensitivity in *Vicia faba* (as measured by postirradiation root growth) by prolonging the exposure time from about 10 minutes to 24 hours is much less marked at 3° C. than at 19° C. If chromosome damage is mainly responsible for the reduced root growth, this observation might be explained by a smaller drop in the 'two-hit' aberration component, resulting from an increased time for which breaks are available for rejoining at 3° C.
"This hypothesis was tested by comparing chromatid frequencies in root meristem cells produced by 105 rads of ^{60}Co γ rays, given at dose rates of 19·4 and 0·073 rads per minute. Beans were maintained in aerated water at 2° C. prior to and during irradiation, and at this temperature the rate of development of cells was such that the two different exposure times both occupied a period during which the cell

sensitivity was approximately constant. Immediately subsequent to irradiation, the roots were returned to 19° C. and examined cytologically.

"All chromatid aberrations were less frequent after low dose rate treatment, but only the chromatid interchange reduction was significant.

"The average time for which breaks are available for reunion, calculated from Lea's *G* function, was found to be 12 hours (95 per cent C.L. 6 to 24 hours)." [Authors' summary].

2275 Davidson, D.
Changes in the chromosome complements of cells of *Vicia faba* roots following irradiation.
J. exp. Bot. 1959 : **10** : 391–98.

Primary roots were X irradiated (620 r.) after one day's germination. The first cells to enter division after treatment showed chromosome breakage and reunion. No quantitative data on number of breaks in the first mitoses were however collected, only the general pattern of breakage being noted. Six types of chromosomal rearrangements were found in the lateral roots. The new complements appeared to be stable since they occurred in several cells of a lateral. Affected laterals contained up to five altered complements. It is suggested that the chromosomal changes were perpetuated because they were induced in initial cells of the primary root.

2276 Sharma, A. K. & Bhattacharyya, N. K.
Experimental study to compare the effect of X-ray on the somatic chromosomes of a few species of monocotyledons.
Cytologia, Tokyo 1959 : **24** : 244–58.

Bulbs of *Haemanthus kalbreyeri*, *Nothoscordum fragrans* and *Zephyranthes mesochloa* and rhizomes of *Colocasia antiquorum*, *Zingiber officinale* and *Curcuma amada* were irradiated with dosages of 250 r. and 500 r. and then allowed to grow. Examination 48 hr. after treatment revealed a high number of fragments. Stickiness, bridges, laggards, micronuclei and structural alterations possibly due to fusion of fragments were also observed. The frequency of fragments was higher after treatment with 500 r. than the lower dose. Fragments persisted for several days after irradiation; in *N. fragrans* they persisted as long as 104 days. Possibly the fragments had passed through several cell generations, being included at random in the daughter cells before they finally degenerated.

2277 Dagnelie, P.
Un problème de génétique résolu par le calcul des probabilités. (**A genetical problem solved by the calculation of probabilities**).
Bull. Inst. agron. Gembloux 1958 : **26** : 322–25.

From *Hordeum vulgare* with 14 chromosomes, seven different trisomics with 15 chromosomes can be obtained. Assuming 13 trisomic plants are available, the probabilities of finding among them a single type of trisomic and of finding 2–7 different types of trisomic are calculated.

2278 Srinivasachar, D.
A case of sub-haploid cells in mitosis.
Cytologia, Tokyo 1958 : **23** : 419–21.

In a squashed root tip of onion, two prophase nuclei each containing seven chromosomes were found in neighbouring cells with unbroken cell walls. Other mitoses in this root had the typical number, $2n = 16$. The two cells were obviously sister ones and must previously have passed through at least one mitosis. The healthy appearance of two nuclei suggested that a second mitosis would also have been completed. Reasons are given for discounting somatic reduction together with translocation as a possible explanation of the origin of the two nuclei.

2279 Butterfass, T.
Ploidie und Chloroplastenzahlen.
(**Ploidy and chloroplast numbers**).
Ber. dtsch. bot. Ges. 1959 : **72** : 440–51.

From a survey of published work, it appears that the number of chloroplasts in mature guard cells of flowering plants and in gametophyte cells of bryophytes increases with increasing level of polyploidy. No exceptions have been found so far. The author's own work showed that in sugar beet the relation was almost linear, the guard cells of octoploid plants having more than six times as many chloroplasts as those of haploids. Aneuploidy sometimes has an effect on chloroplast number. There is some evidence that environmental changes tend to have less effect upon the chloroplast number of guard cells than on that of other cells.

GENERAL BOTANY

2280 Ikoma, I.
(**Sex in strain K-12 of *Escherichia coli*, in particular the intermediate type Fi**).
Idengaku Zasshi/Jap. J. Genet. 1959 : **34** : 125–34. [Japanese].

Acriflavine induced F− cells from F+ cells

and also cells of an intermediate category designated Fi. Fi can mate with F+ and F− and behaves as a recipient to F+ and a donor to F− in recombination. Fi populations are unstable and tend to become transformed into F+ and F−.

2281 Day, P. R. & Holliday, R.
Incompatibility in *Schizophyllum commune*.
Amer. Nat. 1959 : **93** : 387–88.

Raper *et al.* have presented evidence for dividing each of the two mating-type loci into two subunits. Ways of determining whether the two subunits at one locus are identical are now suggested and a possible model for the compatibility reaction is put forward; it involves different alleles interacting to produce a stimulant for dicaryotization and at least three different alleles in each pair of subunits must be present in compatible matings.

2282 Mosolov, I.
(A joint scientific conference on nucleic acids).
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1959 : No. 3 : 137–38. [Russian].

A report on a conference of the USSR Academy of Sciences and its Baškirian branch at Ufa in 1958, together with brief references to papers read by the following authors, is presented. A. N. Belozerskij dealt with the biochemistry of nucleic acids and the effects of the acids upon the growth and development of plants. V. G. Konarev discussed chemical interaction between RNA and pyronin, the use of pyronin or phosphorus for analysis of RNA and a new fluorometric method for determining ribonuclease activity. A. S. Spirin cited experiments showing that plant viruses which had been deprived of their RNA component became uninfectious. Ž. A. Medvedev discussed the nature of interaction of RNA with aminoacids and peptides and the function of RNA in synthesing proteins. M. S. Odincova reported on the RNA contents of chromoplasts in carrot, leucoplasts in sugar-beet roots and leaf chloroplasts of sugar beet, tobacco, spinach, clover and sunflower. R. G. Butenko discussed the content of nucleoproteins in the apical shoots of the lupin and soya bean in relation to photoperiodism; the rate of inclusion of P^{32} in RNA was always greater in long days, while the inclusion of P^{32} in DNA was associated with the photoperiod that was favourable to the development of the reproductive organs of the plant, long days for the lupin and short days for soya bean. G. S. Kuramšin and V. K. Hangil'din dealt with the distribution of DNA and RNA in maize plants and changes in the amounts and distribution of the nucleic acids towards the end of the growth period. E. Z. Oknina discussed increase and reduction in the amount of RNA and DNA at different stages of embryo development and N. A. Satarova described the effects of nucleic acids in promoting plant growth.

2283 Ariyasu, T.
(The effect of density of sowing of pollen on artificial media on germination and pollen-tube growth).
Shokubutsugaku Zasshi/Bot. Mag., Tokyo 1959 : **72** : 473–76. [Japanese].

In experiments in which groups of pollen grains comprising 1–10 grains from any of 5 different species were sown on sucrose agar, it was noted that germination percentage and pollen-tube growth improved as the number of grains per group increased.

2284 Nishiyama, I. & Tsukuda, S.
Radiobiological studies in plants. I. Effect of X-rays upon pollen germination and fertility.
Idengaku Zasshi/Jap. J. Genet. 1959 : **34** : 363–72.

Mature pollen grains of *Lycopersicon pimpinellifolium*, *Narcissus tazetta* var. *chinensis*, *Eriobotrya japonica* and *Torenia fournieri* were X irradiated. Pollen proved to be more radioresistant than dry seeds. In all four species, pollen germination after exposure to 1 x 10^5 r. was normal and tube growth as good as in the controls. With higher doses, germination percentages decreased, reaching 0% or very low values with 5 x 10^5 r. Pollen fertility, studied in *L. pimpinellifolium*, was apparently impaired by lower doses, which did not disturb germination and tube growth. It was however questionable whether fertilization had taken place as the result of application of treated pollen.

TAXONOMY

2285 Bazilevskaja, N. A.
(The problem of species in the studies of Soviet botanists).
Ann. Biol./Ann. Biol., Moskva 1959 : **1** : 125–54. [Russian].

The concept of species is discussed in the light of the definitions given by Timirjazev, Komarov, Vavilov and Mičurin.

2286 Bobrov, E. G.
(The development of the concept of race and of the series method in the Russian school of plant taxonomy).
Bot. Ž. (Bot. J.), Moskva 1959 : **44** : 1553–66. [Russian].
An explanation is given of the system of arrangement of related species within a genus into series, which was employed by K. I. Maksimovič in 1887, and the concept of the geographical race as the basic taxonomic unit enunciated by S. I. Koržinskij in 1892. Both concepts have been accepted and incorporated by V. L. Komarov into his taxonomic systems, which aim at an arrangement conforming to the genetic and evolutionary relationships of the species within the genus.

CROP PLANTS

2287 de Haan, H.
Old and new books dealing with general plant breeding. II. First addition.
Euphytica, Wageningen 1959 : **8** : 252–59.
In this supplement to a previous article [XXIX, 149], 17 further titles are mentioned and comments are made on the books in Czech, Japanese, Portuguese and Turkish listed so far.

2288 **Thirty-ninth report and accounts of the National Institute of Agricultural Botany, Cambridge 1958** : Pp. 56.
The report includes the main results of trials of commercial and experimental varieties of cereals, forage legumes, potato, sugar beet, vegetables and other crops at the Cambridge headquarters and subsidiary centres in England, Wales and Scotland.

2289 Das Institut für Kulturpflanzenforschung im Jahre 1958. **(The Institure for Research in Crop Plants in the year 1958).**
Kulturpflanze, Berlin 1959 : **7** : 5–28.
The work referred to in this report includes genetical studies of *Antirrhinum* and mutation studies of barley, soya bean, tomato, apple and *Vicia faba*. Selection of forest trees and investigation of different races have also been carried out.

2290 Jahrbuch 1957/1958. Deutsche Akademie der Landwirtschaftswissenschaften zu Berlin. **(Yearbook 1957/58. German Academy of Agricultural Sciences, Berlin).**
1959 : Pp. 541.
An account is given of the activities of the academy and of the individual stations maintained by the academy.

Institut für Acker- und Pflanzenbau Müncheberg.
Forage Plants. Genetical and breeding studies with *Lupinus luteus* and *L. angustifolius* have been carried out and two new varieties of *L. luteus* have been developed. One is a tall non-shattering white-seeded type which grows rapidly and has a low alkaloid content; the other variety, Schwako, has more alkaloid and black seeds and is also nonshattering. Strains of rape with a low mustard-oil content and resistance to frost have been produced. Some success has been attained in improving the seed yield of lucerne and investigations on sterility in lucerne have begun. Observations on wild populations of various grass species have continued and many selections have been made.
Fruit. Apple and plum clones have been tested under various environmental conditions and some of the apple clones are superior to cultivated varieties of the same maturity group; also some of the plum clones were found to be outstanding in yield, quality and early ripening. Hybrids of Ernst Bosch x *Malus niedzwetzkyana* have yielded red-fleshed fruit which is particularly suitable for jam production, artificial colouring being unnecessary. In progeny of Taffetapfel [Taffeta apple], a correlation has been found between time of flushing and the inception of flowering. Crosses have been made between 42 clones resistant to *Venturia inaequalis* and other varieties with better fruit. Some of the clones, including one of Antonovka, transmitted high resistance to their progeny. Strains of *Monilia* (*Sclerotinia*) have been found to differ in their virulence on different varieties of sour cherry. Considerable variation in many characters has been found in *Prunus cerasifera* and some seedlings were found to be resistant to frost and adapted to the local climate. An autotetraploid of *P. cerasifera* has been found to be a useful rootstock for plum. Diallel crosses have been made between gooseberry varieties resistant to *Sphaerotheca mors-uvae* and the progenies included 0–30% resistant plants depending on the parents involved; resistance seems to be inherited in a complex way.

Institut für Pflanzenzüchtung Bernburg.
A brief mention is made of breeding of cereal, forage and oil crops, fruits and medicinal plants. Many new maize hybrids and other varieties have been under observation and the fertility of the cross *Zea mays* x *Euchlaena mexicana* has been improved by repeated back

crossing. Promising crosses of winter wheats and of winter barleys with improved cold resistance have been obtained. A rust-resistant and vigorous peppermint and some good flax strains have been developed.

Institut für Pflanzenzüchtung Gross-Lüsewitz.

Clover. The physiology of polyploid clovers has been studied. With a good water supply, tetraploids show increasing superiority in yield as compared with the diploids, when the temperature rises, the period of sunshine increases and the humidity of the air falls; the reverse is true when the polyploids are grown under dry conditions.

Root crops. A new yellow swede has been developed by crossing Mecklenburger Weisse [Mecklenburg White] with other varieties; this swede has improved resistance to viruses. Much attention has been given to breeding disease-resistant and productive potatoes. A test collection of homozygous forms of *Solanum demissum* has been assembled for distinguishing races of *Phytophthora infestans* and a new method for evaluating field resistance to *Ph. infestans* has been developed. Some forms resistant to viruses A and Y have been obtained from the cross (*S. stoloniferum* x *S. tuberosum*) x *S. tuberosum*; about 600 species and strains of wild and primitive potatoes have been tested for resistance to the tobacco brown vein virus and resistant forms have been found in *S. stoloniferum, S. simplicifolium* and the *Commersiana* series. Some valuable F_2 hybrids resistant to nematodes were obtained from the cross (*S. andigenum* x *S. tuberosum*) x *S. tuberosum*. Also nematode-resistant hybrids of *S. vernei* have been produced. Potatoes resistant to all well-known biotypes of *Synchytrium endobioticum* are now available and selections from wild species have shown resistance to biotype G.

Other crops. Progress has been made in improving the frost resistance of marrow-stem kale and better types of rape and mustard have been produced.

Institut für Pflanzenzüchtung Quedlinburg.

The new varieties of vegetables, soft fruits and medicinal plants developed in recent years are listed, details of the parentage being given.

Medicinal plants. A polyploid strain of *Mentha piperita*, Polymentha, was released in 1958; it is superior to diploid varieties in content of essential oil and in rust resistance. A diploid strain of *Digitalis purpurea* with a high glycoside content and a polyploid camomile with an improved content of azulene and a higher yield of the drug have been selected.

Vegetables. A superior polyploid radish suitable for forcing has been developed. Investigations on the cooking quality of peas used for drying are being carried out. The pea Graue Buntblühende [Grey Motley Flowered], which is resistant to fungi of the *Ascochyta* group, was found to contain gallic acid and protocatechuic acid in the testa as well as anthocyanidin, already known to inhibit the development of the fungi; it was shown that gallic acid also has a fungistatic effect. Susceptible varieties do not have these substances.

Institut für Pflazenzüchtung Kleinwanzleben.

Sugar beet. Much attention has been paid to the breeding of polyploids with the aim of improving yield and resistance to *Cercospora* and viruses. The new variety Multverna is resistant to bolting; it was produced by crossing tetraploids with diploid élites of the variety Verna. Crosses between mangels and sugar beets of different levels of ploidy are being studied; triploid hybrids have yielded more sugar per ha. than diploid Kleinwanzleben N, the yield of roots from the hybrids being particularly high. Triploid mangel - sugar beets have also outyielded Rote Walze [Red Cylinder] in dry matter. Selections of sugar beet with 90–100% monogerm seed balls have been obtained. Other selections from various families have shown up to 74% germination at temperatures of 1 or 2° C. Crosses of sugar beet with several wild species are being studied. Some male-sterile strains have been selected.

Forschungsstelle für Agrobiologie und Pflanzenzüchtung Gülzow-Güstrow.

Barley. Selections of winter-hardy productive barleys have been obtained and progress has been made in breeding for awnlessness, early ripening and many-rowed ears.

Forage plants. By means of X irradiation, valuable mutants of *Lupinus luteus* have been produced. A series of early-ripening small-seeded strains of *L. albus* has been developed; these have a close habit of growth. Breeding of strains of *Melilotus alba* with low coumarin content has continued.

Oil plants. More winter rapes able to stand late sowing have been selected. Some improvement in oil content and reduction in the husk proportion of sunflower seed has been attained; also resistance to disease has been improved.

Forschungsstelle für Getreidezüchtung Kloster Hadmersleben.

Cereals. Hybridization of winter wheat continued with a view to combining winter hardiness, rust resistance, suitability for combine

harvesting and good baking quality. Attempts are being made to improve the quality of the spring wheat Peko. Mention is made of the oats Hadmerslebener Auswuchsfester Gelb [Hadmersleben Sprouting-resistant Yellow] which has given outstanding yields [cf. XXVIII, 2882]. Breeding for crown-rust resistance is under way. The new rye Hadmerslebener Hellkorn II [Hadmersleben Bright Grain II] was released in 1958; it equals Petkus in yield, standing capacity and winter hardiness and is of better quality. This variety originated from a cross between Petkus and Heines weisskörniger Winterroggen [Heine's White-seeded winter rye]. Strain 521_{48} has shorter straw and better standing capacity than Petkus and Hadmerslebener Hellkorn II. Strains resistant to sprouting have been selected from the cross 188_{37}, Petkus kurz (weisse Körner) [Short Petkus (white grains)] x 59 Bulgarischer Landroggen [59 Bulgarian land rye]. Heterosis experiments and polyploid breeding have also been carried out with rye. In breeding barleys suitable for combine harvesting, considerable progress has been made by crossing mutants of good standing capacity with foreign varieties. X irradiation of Freja and Elsa yielded several mutants suitable for combine harvesting and superior to the parent varieties in yield. The Hadmersleben strain 3300_{51} has distinguished itself by its high yield and good brewing quality.

Lupin. Some progress in combining high yield with earliness in *Lupinus albus* was achieved in the cross Dr Matthis bitter x 703 kurz [703 Short]. Two early short forms, which are also thermolabile, have been found to be very good for green fodder when sown later. X irradiation of races 1809 and 2635_{50} yielded a range of mutant forms; the useful mutants have been tested for yield and used in various crosses. Selection of plants of *L. polyphyllus* with low alkaloid content has been carried out and crosses made with bitter forms resistant to shattering.

Biologische Zentralanstalt, Institut für Phytopathologie Naumburg.

Fruits. The genetics of specific characters have been studied in some interspecific *Malus* crosses; susceptibility to cold in *Malus* was found to be related to the rhythm of development during the winter. A collection of Russian apple cultivars and hybrids has been tested and some of the varieties are worthy of further study on account of their taste and fruit size. No relationship has been found between resistance to woolly aphis and polyphenoloxidase or peroxidase activity and resistance was also not related to the content of phenolic substances in the skin. Similarly in grapes the peroxidase, catalase and polyphenoloxidase activity and the flavone content and composition were found to be unrelated to resistance to *Phylloxera*. Measurement of electrical conductivity has been found to be a reliable and swift method of determining the frost hardiness of vines and fruit trees.

Biologische Zentralanstalt, Forschungsstelle für Kartoffelkäfer-Bekämpfung Mülhausen.

Potato. Tests for resistance to Colorado beetle have been continued with various *Solanum* species. A polyploid of *S. parodii* showed increased resistance as compared with the original material but polyploid clones of species from the series *Glabrescentia, Demissa* and *Pinnatisecta* showed no improvement. Tests of susceptibility to *Epilachna vigintioctomaculata* were also carried out and it was found that some species were not equally resistant to *Epilachna* and Colorado beetle.

Institut für Gartenbau Dresden-Pillnitz.

Fruits. Two improved apple rootstocks have been selected and some new pear rootstocks have shown good frost resistance. The hips of six varieties of *Rosa pendulina* and *R. glauca* have been found to have high contents of ascorbic acid, which remains stable during the preparation of juice, concentrates and pulp.

Institut für Forstwissenschaften Eberswalde.

Forest trees. Selection of pines resistant to disease has continued; some clones of Weymouth pine have shown resistance to blister rust and also two rust-resistant clones of black poplar have been found. Hybridization experiments with *Betula verrucosa* and *B. pubescens* showed that crossability varies considerably with individual plants.

Institut für Forstwissenschaften Tharandt.

Races and biotypes of *Picea abies* have been found to differ in time of flushing. Differences in growth habit have been noticed between progenies of *Populus tremula* with other species of the *Leuce* section.

Jahrbuch 1958 der Bundesanstalt für Pflanzenbau und Samenprüfung in Wien. (**1958 Yearbook of the Federal Institute for Plant Cultivation and Seed Testing, Vienna**).
Bodenkultur 1959 : 10. Sonderheft : Pp. 180.

2291 *Bauer, R. Tätigkeitsbericht 1958.* (*Report on activity 1958*). (*pp. 1–14*).

The results of trials of cereals, forage plants,

potatoes, mangels and sugar beet are briefly reported.

2292 *Steinberger, J. Zur Methodik der Unterscheidung österreichischer Gerstensorten durch Kornmerkmale.* (*Methods of distinguishing Austrian barley varieties by grain characters*). (*pp. 19–29*).

Austrian barleys were distinguished by testing the grain with phenol and by comparing morphological characters. The phenol test was most conveniently carried out using a 2% solution of phenol at a temperature of 50–60° C., the grain being first examined after 30–45 minutes treatment. Morphological characters varied so much that they could not be used alone for varietal diagnosis. The grain characters of the most important Austrian varieties are described and a key is provided.

2293 *Waltl, K. Tätigkeitsbericht der Qualitätsabteilung.* (*Report on the activity of the Quality Department*). (*pp. 41–56*).

Tests of the malting quality of barleys are reported.

2294 *Nietsch, H. Botanische Sortenbeschreibungen.* (*Botanical descriptions of varieties*). (*pp. 57–63*).

Notes are provided on the morphological characters and tuber quality of the potatoes Erika, Goldsegen and Naglerner Kipfler.

2295 *Meinx, R. Wintergerste-Sortenübersicht und allgemeine Anbaufragen.* (*A survey of winter barley varieties and general questions of cultivation*). (*pp. 64–76*).

The most important characters of eight varieties are described with reference to the results of many trials. The best yields were obtained from Engelens Dea and Firlbecks Vierzeilige [Firlbeck's Four-rowed]; these varieties also showed the best standing capacity. Firlbecks Vierzeilige was highly resistant to powdery mildew. These two varieties had the highest crude fibre contents and Tschermaks Zweizeilige [Tschermak's Two-rowed] had the lowest. The distribution of the eight varieties in Austria is surveyed.

2296 *Zweifler, E. Probleme des Silomaisbaues. Mehrjährige Zusammenfassung der Silomaisversuche.* (*Problems of the cultivation of maize for ensilage. A many-year summary of the ensilage maize trials*) (*pp. 77–94*).

The results are reported of ensilage tests of a series of varieties grown in different districts in Austria; the hybrids were superior to the open-pollinated varieties.

2297 *Graf, A. Beschreibung der in Österreich derzeit gebräuchlichen Zuckerrübensorten.* (*A description of the sugar beet varieties common in Austria at the present time*). (*pp. 95–114*).

Fourteen varieties are described; the information given is based on the results of many trials in dry and damp regions.

2298 *Demel, J. Ergebnisse der Untersuchung von 60 Kartoffelsorten auf Knollenanzahl und Knollengewicht.* (*The results of an investigation of tuber number and tuber weight in 60 potato varieties*). (*pp. 115–25*).

It was found that both the number of tubers produced and the weight of an individual tuber are varietal characters which are not related to the maturity period; the early varieties do however in general produce fewer tubers than the late varieties. Tuber number varied from year to year. In some varieties such as Sirtema and Bintje, the difference between years was not more than 4 tubers but in others such as Beveland and Urtica, differences of up to 13 tubers occurred. These variations depended on the reaction to external weather conditions and photoperiod. The varieties were classified into four groups according to the average number of tubers. Most varieties (57%) had 10–15 tubers and 30% belonged to the group with 15–20 tubers; 8% had more than 20 tubers and only 3% produced less than 10 tubers.

2299 Instytut Uprawy, Nawożenia i Gleboznawstwa. Wyniki doświadczeń zakładów doświadczalnych za lata 1954–1955. (**Institute for Agriculture, Manuring and Soil Science. Results of experiments and experimental stations for 1954-55**). Pp. 310 + 268.

In addition to the information referred to below, the reports include data on varietal tests of maize, tomatoes, red peppers, beet, onions, French beans, peas, cauliflower, cabbage, carrot, cucumber, spinach and lettuce.

Wheat. The best variety in four-year trials at Poświętne was Wysokolitewska Sztywnosłoma [Stiff-strawed Tall Lithuanian], characterized by resistance to cold, drought and rust, and short straw free from lodging. Other good varieties were Kujawianka Więcławicka, Leszczyńska Wczesna [Early Leszczyńska] and Ostka Złotokłosa [Awned Yellow].

Tests of five ecotypes of Kujbyšev spring wheat showed them all to be inferior in straw strength to the local spring wheat Chłopicka.

2300 JÁNOSSY, A.
Növénynemesítésünk helyzete, eredményei és feladatai. (**The present position, results and tasks of Hungarian plant breeding**).
Magyar tud. Akad. Agrártud. Oszt. Közl. 1959 : **16** : 151–67.

A survey of progress in Hungarian breeding since 1916 is presented, with special reference to the period since 1950. The crops mentioned include wheat, maize, potato, sugar beet, sunflower, hemp, legumes, tomato and red pepper.

2301 POGOSOV, È. K.
(**Improving the work in state varietal testing**).
Selekcija i Semenovodstvo (Breeding and Seed-growing) 1959 : No. 2 : 50–51. [Russian].

Ivanov's proposals for improving the work of the State Varietal Commission are broadly accepted, with the exception of his last recommendation [cf. XXIX, 1294]; Pogosov holds that organizations engaged in testing varieties should also be allowed to carry on breeding research. In addition, he recommends that a provision should be made for testing varieties for differences in their cultural requirements. For instance experiments with tomatoes at Kizljar, North Osetia, showed that Skorospelyj Volžskij 288 [Early Volga 288] needed less wide spacing than Majak 12/20–4 [Lighthouse 12/20–4].

2302 ISOTALO, A.
Maatalouden koe- ja tutkimustoimintaa Lapin läänissä. (**Agricultural experimental and research work in Lap districts**).
Koetoiminta ja Käytäntö 1959 : **16** : p. 1.

Spring wheat. The variety Apu [Aid] is most satisfactory.
Oats. Orion III outyielded Tammi by 19% in the experiments. Nip, a late variety, also outyielded Tammi.
Rye. The most suitable variety is Toivo [Hope].
Barley. The highest yielding varieties are Åsa, Edda II, Tammi and Pirkka, of which the first gave the best result.

2303 VARIS, E.
Kesän 1958 koetuloksia. (**Experimental results for the summer of 1958**).
Koetoiminta ja Käytäntö 1959 : **16** : p. 4.

Field trials at the Hannkkija trial ground gave the following results.

Winter wheat. The line b2598 overwintered as well as Varma [Sure] and gave a 55% higher yield on sandy soil, as well as a 16% increase on clay soil. The Swedish variety Diana, with slightly poorer overwintering qualities, gave a 31% increase in yield over Varma on clay soil but did badly on sand. Other lines showng promise, particularly on sandy soil, are a7013, a5333 and 04819.
Rye. The overwintering properties of Ensi [First] are superior to those of other varieties tried.
Root crops. Polyploid root crops which have distinguished themselves by their high yield are the Swedish turnip Sirius and the Dutch mangel Polybarres.
Potato. The early fodder potato A75 is promising and also the medium-early starch potato A500.
Tests for flavour indicate Eigenheimer to be the most satisfactory.

2304 ÅKERBERG, E.
Några intryck från växtförädlingen i Sovjetunionen. (**Some impressions of plant breeding in the Soviet Union**).
Sverig. Utsädesfören. Tidskr. 1959 : **69** : 323–32.

An account of the breeding work seen by the author during a three weeks' trip to the USSR in July 1959 is presented. Special attention is given to the work on wheat, but other cereals, grasses, legumes and potato are also referred to.

2305 KIRICENKO, F. G.
Concluziile principale ale lucrărilor Institutului Unional de Ameliorare și Genetică "T. D. Lîsenko". (**The principal results of the work at the T. D. Lysenko All-Union Institute of Breeding and Genetics**).
An. Romîno-Soviet. : Ser. Agric.-Zooteh. 1959 : **13** : No. 2 : 83–89.
[Cf. XXIX, 3517].

2306 Arbetsplan för Weibullsholms Växtförädlingsanstalt för år 1960. (**Plan of work for the Weibullsholm Plant Breeding Institute for the year 1960**). Pp. 46.

In addition to work on cereals, grasses, forage legumes, root crops, *Capsicum*, rape, linseed, beetroot, carrot, parsnip, radish, onion, leek, cabbage, kale, cauliflower, broccoli, spinach, lettuce, celery, melon, cucumber, tomato, bean, pea and dill, most of which has been reported in previous years [cf. XXIX, 2306], the following projects and results are mentioned.

Radish. A new outdoor radish, Perfecta, is being released.

Cauliflower. Breeding is directed towards the production of late varieties and several crosses involving the late variety Atle have been effected.

Lettuce. In the hope of obtaining useful mutants, Urania and W:s/131 have been X irradiated; the former variety has also been treated with ethyleneimine.

Cucumber. A new F_1 hybrid of the Butchers type is undergoing trial; designated K98, it is early and very productive. Mildew-resistant American and Canadian varieties are being crossed with Swedish material. Producer W:s/57, previously known as Fortuna, is a high-yielding outdoor cucumber for pickling.

Phaseolus. Crosses between *Ph. vulgaris* and *Ph. multiflorus* are generally only successful with the former as mother plant, but a number of the reciprocal crosses have also succeeded. The hybrid material is hardy in the germinating and seedling stages and resists several fungal diseases.

Pea. Sigyn/58, a canning pea, was recognized as a first-class variety in state trials and is to be released in 1961 [cf. 838]. The ability to withstand attack by soil fungi under unfavourable weather conditions when sown early is being investigated in some marrowfat crosses. Peas which have the sugar-pea type of pod and carry the genes *Pv* tend to become tough-podded through the mutation of *v* to *V*. Tender-podded nonmutating types carrying *pV* have been developed.

Dill. The rapidly-growing forcing dill released in 1957 has received the name Aurora [cf. XXIX, 2306].

2307 Roland, M.
Nytt från Bjertorp. (**News from Bjertorp**).
Weibulls Årsb. Växtföräd. Växtodling 1960 : **55** : 18–21.

The red clover Rea and the Alsike clover Tetra, both tetraploids, are doing well at the above branch of the Weibullsholm Plant Breeding Institute. New kales developed from crosses among marrow-stem kale, cabbage, Brussels sprouts and broccoli are leafier and higher in yield than normal marrow-stem kales and are not very susceptible to frost.

2308 Vestergaard, E.
Abed Planteavlsstation. (**Abed Plant Breeding Station**).
Planteavl. Loll.-Falster. 1959 : 5–18.

Wheat. Material from Capelle x Weihenstephan I, the reciprocal and Hunsballe x Weihenstephan I shows promise of combining high yield and stiff straw with resistance to leaf diseases.

Oats. In comparisons of stiff-strawed lines of Max and Palu with foreign varieties in the dry summer of 1959, the foreign material gave higher yields.

Barley. With the exception of Minerva and Heine 4808, all varieties, including Mentor, were attacked by mildew in 1959, indicating that other races than A and D were involved. Thirty breeding lines are undergoing testing and selection.

2309 Thøgersen, O.
Beretning om landboforeningernes virksomhed for planteavlen på Sjælland 1959. (**Report on the work of the agricultural associations on crop production in Sjælland, 1959**).
1960 : Pp. 275.

Results are given of field experiments carried out by local associations in Sjælland, Denmark, including varietal trials of wheat, oats, rye, barley, lucerne and potato.

2310 59. beretning om planteavlsarbejdet i landboforeningerne i Jylland. (**59th report on the crop production work of the agricultural associations in Jutland**). **1959** (1960) : Pp. 667.

Among the details reported here of field experiments conducted by local agricultural associations in Jutland, Denmark, are the results of varietal trials of wheat, oats, rye, barley and potato.

De eerste tien jaren. (**The first ten years**).
Meded. Sticht. PlantVeredel., Wageningen 1958 : No. 20 : Pp. 108.

2311 *Veenstra, G. Tien jaren. Stichting voor Plantenveredeling.* (*Ten years. Plant Breeding Foundation*). (*pp. 7–29*).

After an outline of the organization of the Plant Breeding Foundation and its relation to other plant breeding institutes in the Netherlands, the author surveys the current breeding work of the foundation. This includes work on serradella, vetch, fodder rape, oil rape and poppy, as well as the crops mentioned below.

Cereals. Breeding for hardiness, disease resistance and adaptation to sandy soils is in progress with wheat, barley and oats [cf. 2316].

Grasses. Selection for absence of siliceous teeth on the leaves is under way in cocksfoot [cf. XXVIII, 3861]. In ryegrass species, cold resistance in the freezing chamber shows good

correlation with winter hardiness. Other work is described below [2320–1].

Red clover. In addition to testing and breeding for eelworm resistance [cf. 2322], breeding for resistance to *Sclerotinia trifoliorum* is in progress.

Lupin. Through the use of wild forms from Palestine, Spain and Portugal in breeding *Lupinus luteus*, improvements in rapidity of spring development, shattering resistance, earliness, disease resistance, yield of green matter and other characters have been obtained.

Beet. [Cf. 2317–8].

Turnip. [Cf. 2323].

Potato. Parental lines carrying the genes R_1, R_2 and R_3 for blight resistance have been developed, also lines duplex and triplex for R_3. Breeding for eelworm and virus X resistance is referred to below [cf. 2313]. Testing and selection for leaf-roll resistance are carried out every year, clones remaining free from infection for three successive years being used in crosses. A German *Solanum stoloniferum* derivative carrying a gene for resistance to all strains of virus Y and also to virus A is being used in breeding. In tests against a new wart race, progenies of Rode Star [Red Star] were partially resistant and Ultima and Urgenta were not infected. *S. chacoense* bears a recessive gene conferring resistance to Colorado beetle. Preliminary tests against *Fusarium* indicate that resistance is determined by many genes, each with a small effect. An Indonesian potato is resistant to *Pseudomonas solanacearum* and has given partially resistant offspring in crosses with *S. tuberosum*. A variety of *S. curtilobum* and some of its hybrids with *S. tuberosum* are tolerant of several degrees of frost.

Flax. Breeding for resistance to various diseases, including rust [cf. 2315], is in progress. Linseed breeding is of less importance than previously.

2312 *Toxopeus, H. J. Voorlopige resultaten van het onderzoek van de Wageningse Aardappel Collectie* (*W.A.C.*). (*Preliminary results of the investigations on the Wageningen Potato Collection*). (*pp. 30–37*).

A collection of a large number of samples from South America is being maintained at Wageningen, Netherlands, and includes the diploid species *Solanum stenotomum* and *S. ajanhuiri*, the triploid *S. juzepczuckii*, the tetraploids *S. acaule* and *S. tuberosum* ssp. *andigenum* and the pentaploid *S. curtilobum*. Among these, four, or possibly seven, samples of *S. tuberosum* ssp. *andigenum* from Bolivia and northern Argentina proved highly resistant to *Heterodera rostochiensis* and one appeared to be resistant also to a new race attacking CPC1673. A factor controlling immunity from virus X occurred in *S. tuberosum* ssp. *andigenum* seedlings and in *S. curtilobum*. The last-mentioned species is tolerant of frost and crosses well with potato to give an F_1 with many hardy individuals. Frost-tolerant clones of *S. stenotomum* and *S. ajanhuiri* were also found.

Among 22 samples tested, four were resistant to a new race of *Synchytrium endobioticum*. High resistance to *Fusarium coeruleum* (*Hypomyces solani*) was present in a small proportion of the collection. *S. goniocalyx* has been used as a source of quality in crosses with Eigenheimer and Furore; further crosses are needed to improve the blight resistance and tuber shape of the hybrids.

The collection is also being evaluated for resistance to virus Y, leaf roll and blight and for quality and productivity.

2313 *Huijsman, C. A. De veredeling van de aardappel op resistentie tegen aardappelmoeheid.* (*Breeding potato for resistance to potato sickness*). (*pp. 38–42*).

Breeding for resistance to *Heterodera rostochiensis* is surveyed, with particular reference to the transference of monogenic dominant resistance from the *Solanum andigenum* line 1673 [cf. XXVI, 505] to commercial varieties. The preliminary stages were carried out by the Plant Breeding Foundation, the later by private breeders. Resistant lines equalling commercial varieties in yield have been obtained and breeding is now in progress for resistance to new races of the parasite.

2314 *Thijn, G. A. De opbouw van aardappelgeniteurs.* (*Producing parental plants in potato*). (*pp. 43–48*).

Since the ability of different potatoes to transmit desirable characters to their progeny is extremely variable, selection for good parent plants should precede selection for valuable types in hybrid populations. In the Netherlands the basic parental selection is carried out at the state institutes and hybrid populations developed from the selected parents are then sent to breeders for further selection. Parental combinations giving good offspring include Black 1256 x Libertas, Bintje x 354, Engelum Y226 x IvP47–87–7, Engelum Y226 x Voldagsen 19268, Record x 654 and Saskia x A3 (CPC1673 x Furore).

2315 *Wiersema, H. T. Veredeling op roestresistentie bij vezelvlas.* (*Breeding for rust resistance in flax*). (*pp. 49–57*).

Breeding work at the Plant Breeding Foundation is concerned with the transference of genes for resistance from American, Australian, Argentine and Russian flax varieties to Wiera and other varieties on the Netherlands varietal list, the back-crossing method being used. The genes in these resistant parents have not been identified with certainty since the requisite physiological rust races do not occur in the Netherlands, and use is also being made of known genes from resistant Netherlands varieties of flax and linseed.

2316 *Dantuma, G. Enkele ervaringen met de veredeling van tarwe, gerst en haver op lichte gronden.* (*Some experiences in breeding wheat, barley and oats for light soils*). (*pp. 58–61*).

In order to do well on sandy soils, winter wheat and winter barley require good winter hardiness and rapid spring growth favouring resistance to spring drought. Greatest resistance to summer drought in winter wheat, spring barley and oats is found in long-strawed varieties.

In winter wheat, crosses are being made between very winter-hardy continental varieties and leafy varieties with rapid spring development. *Triticum persicum* is being used as a source of mildew resistance.

Winter barley parental material includes winter-hardy American and Rumanian varieties, the wild summer barley *Hordeum spontaneum* var. *nigrum*, which is useful both as a source of mildew resistance and as a means of increasing winter hardiness, and MOB575 which is resistant to loose smut and tolerates low pH.

Spring barley crosses have the aim of combining the stiff straw of Herta and Rika with the long straw and resistance to mildew and yellow rust of some German varieties.

2317 *Cleij, G. De waarde van de symptomenbeoordeling en de bepaling van het virusgehalte voor de veredeling op tolerantie tegen de vergelingsziekte bij voeder- en suikerbieten.* (*The value of symptom assessment and estimation of virus content in breeding for tolerance of yellows in mangels and sugar beets*). (*pp. 62–65*).

Selection of yellows-tolerant material showing the least possible reduction in yield normally necessitates extensive yield trials. Attempts to obviate this need were unsuccessful, since neither severity of symptoms nor virus content of the leaves, as determined serologically, was sufficiently correlated with tolerance to be used as a basis for selection.

2318 *Kloen, D. Enkele ervaringen met triploiden bij de veredeling van bieten.* (*Some experiences with triploids in beet breeding*). (*pp. 66–70*).

The percentage of triploids obtained by natural crossing varied according to the system of planting the parents, values of over 90% being obtained from tetraploid seed parents surrounded by diploids in a ratio of about 1 : 5. Tetraploid mother plants high in dry-matter content generally transmitted this character to the triploid offspring in crosses with diploids low in dry matter. Several of the tetraploid parents gave triploid progenies which were heterotic in yield of dry matter, even when the diploid parent was low in dry-matter content, suggesting that the diploid parent influenced the root volume of the hybrid, while the tetraploid affected the dry-matter content. It is concluded that combinations between tetraploids high in dry matter and high-volume diploids are likely to be the most promising.

2319 *Speckmann, G. J. Enige technische aspecten aangaande het produceren van polyploide gewassen.* (*Some technical aspects of the production of polyploid crops*). (*pp. 71–74*).

Techniques used in inducing polyploids with colchicine and methods of identifying induced polyploids are briefly surveyed.

2320 *Wit, F. De betekenis van polyploiden voor de veredeling van raaigrassen.* (*The significance of polyploids in ryegrass breeding*). (*pp. 75–81*).

In comparisons of colchicine-induced tetraploids of perennial, Italian and Westerwolth's ryegrass with the corresponding diploids, the tetraploids were generally better in early development and spring growth, and remained green longer when exposed to drought or excessive moisture. In Italian ryegrass, tetraploids were better than diploids in cold resistance and winter hardiness. In perennial ryegrass, the tetraploids equalled or surpassed the diploids in this character and in rust resistance only after selection and crossing, but were superior in lodging resistance even before selection. Tetraploids of Westerwolth's ryegrass and selected clones of Italian and perennial ryegrass exceeded the diploids in yield. The tetraploids were all lower in dry-matter content. The initially low seed yield of the tetraploids could be increased by selection. On the basis of these preliminary results it is thought that the tetraploids can be

rendered superior to the diploids in most of the above characters.

It is noted that hybrids of diploid ryegrasses with tetraploid *Festuca pratensis* are fairly easily produced and that some of these show promising vegetative development.

2321 *van Dijk, G. E. Toetsing in mengteelt bij timothee.* (*Testing of timothy in mixed cultures*). (*pp. 82–87*).

The yields of hay types and pasture types of timothy tested in mixtures with other grasses and white clover bore no clear relation to the yields in unmixed cultivation, a correlation coefficient of +0·25 being obtained in an experiment with a timothy/perennial ryegrass mixture. Testing of selections in mixed culture is therefore advocated. By sowing alternate rows of the test material and a competitor species, at row spacings of 7·5–10 cm., the competitive ability of the selection may be tested without the laborious sorting of species that a mixed sowing would involve.

2322 *Dijkstra, J. Het kweken van rode klaver met resistentie tegen het stengelaaltje* (Ditylenchus dipsaci). [*Breeding red clover with resistance to stem eelworm* (D. dipsaci)]. (*pp. 88–96*).

A method of testing seedlings for resistance is described. Repeated crossing and selection of resistant plants obtained by this method have yielded 138 families, 44% of which contain 0–5% susceptible plants and only 9% contain more than 15% susceptible plants. The selected lines are also resistant to eelworms from areas other than those from which the original inocula were obtained. Field resistance has shown good correlation with seedling resistance. Attempts to combine resistance with other desirable characters and to analyse the inheritance of resistance are being made.

2323 *Lamberts, H. Enkele aspecten bij de veredeling van stoppelknollen.* (*Some aspects of turnip breeding*). (*pp. 97–103*).

Field tests in infected ground have led to the selection of club-root resistant lines of Halflange Witte Blauwkop [Half-long White Bluehead]. When sown in August, the F_1 progenies of crosses between inbred resistant and susceptible lines were resistant, as were the open-pollinated offspring of the resistant lines. With earlier sowing, however, this type of resistance was ineffectual and incidence of the disease was higher, allowing further scope for selection. Selection for resistance against a newly discovered physiological race has also been initiated.

In selecting for high dry-matter content, a boring about 1 in. in diameter taken one third of the way down the root proved to be satisfactorily representative of the whole turnip. High content in the mother plant was generally transmitted to the progeny and lines with increased dry-matter content and no diminution of total root weight have been developed. Families with reduced mustard-oil content have been selected through the use of chemical and paper-chromatographic methods. These improvements in resistance, yield and quality have been attained in the course of three or four generations of selection.

2324 Verslag van het landbouwkundig onderzoek in Nederland over 1957. (**Report on agricultural research in the Netherlands, 1957**). Pp. 180.
Verslag landbouwkundig onderzoek in Nederland, 1958. (**Report on agricultural research in the Netherlands, 1958**). Pp. 192.

Besides the studies referred to below, previously described work on *Brassica*, medicinal plants, tomato, cucumber, endive, asparagus and *Phaseolus* is mentioned [cf. XXIX, 166 and XXX, 167].

Wheat. Breeding for resistance to yellow rust and mildew and for early maturity continued at the Plant Breeding Foundation. At the Agricultural Crop Breeding Institute, two types of semilethality have been found, namely dwarfing and withering. The latter appears to depend upon three complementary factors, allowing seven withering genotypes to be distinguished. In some crosses, withering and dwarfing are combined in the F_1.

Rye. The method of recurrent selection is under study. Land races from the Balkans have proved unattractive while wild and semiwild ryes from central Asia appear to be of some interest. Fertility and cytology are being investigated in tetraploids.

Barley. Breeding for adaptation to sandy soils is in progress. Complete mildew resistance has been obtained in the progeny of a wild species crossed with winter and summer varieties. The two-rowed spring barley Delta, newly admitted to the varietal list, has stiff straw and large, plump grains and gives high yields. Netherlands samples of *Hordeum murinum* and a few English and Italian ones all had $2n = 28$, although the species has been reported to have $2n = 14$; meiotic behaviour and chromosome morphology indicated that the plants were allopolyploids.

Grasses. Tetraploid ryegrasses have continued to do well. Crosses of *Lolium perenne* with *L. multiflorum* produced 10% higher yields during two-year trials than the standard hay-type variety of perennial ryegrass and were more persistent when grazed. Numerous hybrids of *Lolium* and *Festuca pratensis* have been obtained, some of which have yielded many seeds. It appears likely that soft-leaved wild populations of *F. elatior* have arisen through hybridization of *F. pratensis* and *L. perenne*. Mosaic resistance is occasionally found in *Lolium* species. F_2 timothy plants from crosses between grazing and hay types were mostly intermediate in heading time between the early and late varieties, with a high correlation between the heading date of the F_1 clones and that of their progenies; variation in heading date within the families was small and green-matter production was good. Crosses between Russian and Netherlands cocksfoot clones gave seedlings showing rapid development after sowing.

Red clover. Yields 40–200% higher than those of commercial varieties have been found in material selected for resistance to stem eelworm. Tetraploid families have outyielded diploids in many trials.

Lupin. The cross *Lupinus luteus* x *L. rothmaleri* has been effected and successfully back crossed to *L. luteus*. A line combining rapid early growth with resistance to night frosts has been found.

Beet. Compared with the 50–55% depression in dry-matter yield found in yellows-infected commercial sugar beets and mangels, the best bred material showed about 20% depression. Yellows tolerance appears to be dominant over susceptibility and the combination of tolerance with other desirable features is in progress. A number of tetraploids and hybrids between tetraploids have outyielded their constituent diploids. Good seed quality has been found in some monogerm material.

Selection for eelworm tolerance is proving effective and hybrids of immune varieties have been obtained.

Turnip. Marked heterosis was observed in many inbred lines following open pollination. Types with a low mustard-oil content in leaves and root have been found. An increase in dry-matter content of about 25% has been obtained by selection, and in a few cases is unaccompanied by a decrease in productivity. A tetraploid form from the Centraal Bureau is more resistant to club root than all other varieties and has given very high yields.

Potato. At the Plant Breeding Foundation a further variety of *Solanum andigenum* was found to be resistant to root eelworm. Frost-resistant *S. curtilobum* forms have been used in crosses with commercial varieties and have given some resistant seedlings. Crosses involving material carrying the *R* genes for blight resistance have also been effected. In *S. kurtzianum* resistance has been found both to the common eelworm race and to some isolates of the form attacking the previously resistant variety CPC1673; resistance is dominant and appears to be governed by a few genes. *S. vernei* seems to be resistant to all biotypes. Immunity against virus X occurs in *S. andigenum* and *S. curtilobum*. Extreme resistance to virus Y is closely linked to virus A resistance and is effective against all strains of Y. Planting of seedlings in soil artificially infected with scab causes severe and regular attack which is expected to be useful in selection.

At the Agricultural Crop Breeding Institute, it has been shown that a wart race from Newfoundland differs markedly from race D and shows some resemblance to the German race G. There is some evidence that resistance to race G includes resistance to race D. In *S. demissum*, polymeric inheritance of flower colour has been established; inheritance of hypersensitivity to *Phytophthora infestans* also appeared to be of this type. Chromosome doubling in diploid Andean material has yielded plants which are indistinguishable from, and can readily be crossed with, *S. tuberosum*. Highly blight-resistant Mexican forms could not be crossed with *S. tuberosum* but have been crossed with other wild species. Frost resistance has been found in *S. ajanhuiri* and in some F_1 hybrids of *S. demissum* x *S. tuberosum*.

The seedling CB4739–56 has been admitted to the varietal list under the name Remona. It is a productive variety with well-formed tubers of good table quality and carries the factors R_1 and R_3 conferring a high degree of blight resistance.

At the Research Institute for Agricultural Crop Varieties, it has been established that in late-maturing varieties the vegetative period may be shortened by short-day treatment; yields under long and short days are similar.

Flax. A new Wiera selection, line 14, equals Wiera in yield but is more uniform in flowering and maturity.

Apple. Seven years' selection in successive generations of Antonovka x Jonathan has given a scab-resistant variety which is also highly satisfactory in fruit form, colour and quality.

Tomato. The F_1 of *Lycopersicon glandulosum*

x Moneymaker, which is resistant to corky root, eelworm and leaf mould, has been back crossed to various cultivated varieties.

2325 5e Jaarverslag. Proefstation voor de Groenteteelt in de Volle Grond in Nederland. (**Fifth annual report. Experimental station for outdoor vegetable growing in the Netherlands**).
Alkmaar 1959 : Pp. 103.

In addition to the work described below, varietal trials of strawberry, beetroot, celeriac, leek, cauliflower, spinach, rhubarb, lettuce, chicory and cucumber have been carried out. Also, testing of asparagus and pea selections is under way and breeding of Witloof chicory has begun. **Potato.** About 81% of the crosses effected showed resistance to blight or eelworm or both. First-year seedlings selected for cold resistance show many wild characters and can be used only as parents. Third-year material combining resistance to wart and eelworm is being entered for official trials.

Phaseolus. Material resistant to anthracnose and virus diseases has been found in crosses among *Ph. vulgaris* types, in *Ph. vulgaris* x *Ph. dumosus* back crossed to Dubbele Witte zonder draad [Double White Stringless] or Aromata, and in crosses of dwarf slicing beans with *Ph. coccineus* 'Emergo'. Snap beans crossed with Imuna or Processor tended to produce tough-podded progeny. A hard-podded white bean from Imuna x Kievit van Cooten has shown promise. Tabulated data on pod set in crosses involving various combinations of snap bean and slicing bean with *Ph. dumosus* and *Ph. coccineus* are provided.

2326 Brežnev, D. D.
(**Agriculture in the People's Republic of Bulgaria**).
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1959 : No. 3 : 92–98. [Russian].

Oat varieties resistant to lodging which outyield the previous standard 905 and winter barleys exceeding the variety 1337 in yield and resistance to frost and lodging are among the new varieties bred at the various branches of the Bulgarian Institute of Plant Industry. Others include potatoes with high tuber yields and resistance to degeneration, a rose highly productive of petals and essential oil and resistant to frost and *Phragmidium mucronatum*, and heterotic hybrids of tomato and of *Capsicum* distinguished by high quality of the fruit.

Omagiu lui Traian Săvulescu cu prilejul împlinirii a 70 de ani. (**Homage to Traian Săvulescu on the occasion of his 70th birthday**).
Editura Academiei Republicii Populare Romîne 1959 : Pp. XXXVII + 1179.

2327 *Teterevnikova-Babajan, D. N.* (*Fusarium wilt of tomatoes under the conditions of the Armenian SSR*). (*pp. 1–10*). [*Russian*].

All tomato varieties, including new vegetative and sexual hybrids, grown in the Ararat valley were found to be susceptible to wilt, though varietal differences in the degree of resistance were observed. All the partially resistant varieties, such as Anait 20 and hybrids 102, 150, 153 and 168, were bred at the Armenian Branch of the USSR Institute of Preserving and Vegetable-drying.

2328 *Basile, R. Rassegna di razze fisiologiche di* Puccinia graminis *var.* tritici *isolate da* Berberis vulgaris *L. e.* B. aetnensis *Presl., raccolti in Italia durante l'estate 1957.* (*Review of physiologic races of* P. graminis *var.* tritici *isolated from* B. vulgaris *L. and* B. aetnensis *Presl. collected in Italy during the summer of 1957*). (*pp. 37–42*).

The isolates contained three entirely new races which have been assigned the numbers 259, 279 and 293; races 123 and 98 were found for the first time in Europe. The most common race was 21, but the virulent races 34 and 75 were found fairly frequently.

2329 *Christoff* [*Hristov*], *A. Der Rost der Steinobstarten in Bulgarien.* (*Rust of stone-fruit species in Bulgaria*). (*pp. 139–55*).

In this general account of the biology and occurrence of *Tranzschelia pruni-spinosae* in Bulgaria, data are given showing how the development of uredospores and teleutospores varies on different species of *Prunus*; on *P. mahaleb* no uredospores were found in 1936. The susceptibility of nine plum varieties growing in Čiflik in the Trojan region was assessed in 1951. The least susceptible varieties were Montfortpflaume [Montfort plum], Belle de Louvain, Frühe Reineclaude [Early gage] and Violette Reineclaude [Violet gage]. In Smoljan and Drjanovo, the gages have suffered moderate or severe attacks. This difference is due to the occurrence of two forms of the pathogen with different geographical distributions; in Čiflik, *T. pruni-spinosae* f. *typica* was present while f. *discolor* occurred in Smoljan and Drjanovo.

Other varieties also show differences in susceptibility to the two forms of the pathogen.

2330 *Hassebrauk, K. Die Getreiderostsituation in Europa, kein kontinentales, sondern ein interkontinentales Problem.* (*The cereal rust situation in Europe, not a continental but an intercontinental problem*). (*pp. 275–81*).

Data have been assembled on the occurrence of races of *Puccinia graminis* var. *tritici* and *P. triticina* in Europe, Africa and Asia. The information available is far from complete and a plea is made for more international cooperation in identifying rust races and in controlling rusts by resistance breeding and other measures.

2331 *Iuga, V. G. & Scobiola, X. Despre principalele Apoide polenizatoare ale lucernelor.* (*On the principal Apoideae pollinating lucerne*). (*pp. 337–46*).

The principal pollinators in Rumania are short tongued bees of the genera *Andrena, Halictus* and *Melitta*.

2332 *Murav'ev, V. P.* (*Training plants for improvement in resistance*). (*pp. 519–28*). [*Russian*].

The wheats Ukrainka and Lutescens 17 which had been given dressings of N, K, P or P + K or small does of B, Mn, Cu, Zn or Mg for three consecutive years showed improved resistance to bunt at Kiev. The improvement is said to be heritable. Treatments with P, P + K, Mn or Zn were the most effective. Ukrainka, which is less resistant to bunt than Lutescens 17, showed a greater response to the treatments than the other variety.

2333 *Podhradszky, J. Zwei physiologische Formen des Weizenzwergsteinbrandes in Ungarn.* (*Two physiological forms of wheat dwarf bunt in Hungary*). (*pp. 601–10*).

These two forms differ in the rate of germination of the spores, susceptibility to small changes in the environment and in their effect on tillering in the wheat Bánkút 1201. In some respects these forms resemble North American and Turkish strains.

2334 *Stakman, E. C. The need for international cooperation on cereal rusts.* (*pp. 745–53*).

Reasons are given for the desirability of international cooperation in elucidating the epidemiology of cereal rusts and in developing resistant varieties.

2335 *Verderevskij, D. D.* (*The development of immunity from infectious diseases in plants*). (*pp. 811–23*). [*Russian*].

Single-plant selection for disease resistance among artificially infected varieties and forms which are susceptible to a particular pathogen is recommended as a method of breeding for immunity. Experiments with different plants based on this method were conducted by the Kišenev Agricultural Institute. The results include selections of the cottons 108F, 611B, Od1, 3521U and 6466U which were resistant to *Xanthomonas malvacearum* and selections of *Vitis vinifera* varieties immune from *Plasmopara viticola*. Work on selection of the wheat Odessa 3 for immunity from *Puccinia triticina* is in progress, while some maize plants immune from *Ustilago zeae* have already been selected. An indication of the amount of plant material required for selection of immune individuals is provided by the work on selecting the tobacco Trebizond for immunity from tobacco mosaic virus; only four immune plants were found among 61,625 plants investigated.

2336 *Bordeianu, T. Soiurile autohtone de pomi și importanta lor pentru pomicultură.* (*Indigenous varieties of fruit trees and their importance in fruit growing*). (*pp. 865–72*).

Local varieties of apple, pear, quince, plum, sweet and sour cherry, apricot and walnut identified in the recently conducted survey of local Rumanian varieties of fruit trees are listed. These varieties are regarded as promising material for breeding on account of such characters as local adaptability, vigour, productivity and longevity.

2337 *Constantinescu, G. & Oșlobeanu, M. Schema de selecție clonală și înmulțire rapidă a viței de vie.* (*The scheme of clonal selection and rapid multiplication of the vine*). (*pp. 885–96*).

A scheme of clonal selection being used in Rumania is described. It requires 5 years to complete and involves comparative observations on the mother plants, and on grafted and own-rooted clones selected from them during this period.

2338 *Priadcencu, A., Gologan, I., Dalas, V., Scumpu, N. & Greceanu, E. Contribuții la stabilirea soiurilor de orz de toamnă potrivite pentru Moldova.* (*Contributions towards establishing which varieties of winter barley are suitable for Moldavia*). (*pp. 935–44*).

Five lines selected in recent years at Cenad were

compared, with special attention paid to yield, quality and winter hardiness. Cenad 345 proved most satisfactory.

2339 MANOLIU, M.
Din problemele ameliorării plantelor în R.P.R. (**On some plant-breeding problems in the Rumanian People's Republic**).
Probl. Agric., București 1958 : **10** : No. 7 : 7–13.

In reply to some criticisms of Rumanian plant breeding made by G. Gheorghiu-Dej at a recent conference in Constanța, the author outlines current projects and the results that are to be expected.

2340 CHANDRARATNA, M. F.
Administration Report of the Director of Agriculture for 1958. Part IV —education, science and art (C).
Dep. Agric. Ceylon 1959 : 125–216; also in Sinhalese, 1–101; and Tamil, 103–24.

Rice. Heritability tests on indigenous varieties indicated potentialities for marked improvement if appropriate techniques of selection are applied. Six F_2 populations had high heritability values for seed size, the genetic correlation between seed length and width being low. Evidence was obtained that varietal disparities in seasonal sterility may merit consideration in breeding as a factor affecting yield. Varietal resistance to salinity could be determined by growing young plants for a few days in a 1% solution of salt. Several local varieties have been improved in yield by selection. In the continued programme of hybridization, emphasis was laid on breeding for blast resistance, since most indigenous varieties are susceptible. Recent selections of hybrid origin and introductions were used as sources of resistance. Hybrid progenies in which the Indonesian variety Mas featured as a parent showed promise. At Bombuwela, several hybrid derivatives exhibited considerable resistance to both iron and hydrogen toxicity. The most promising strains obtained by introduction, selection or hybridization were subjected to yield trials at the various stations. H–4 and H–5, both derived from Murungakayan 302 x Mas, excelled at Batalagoda and H–501 at Labuduwa [cf. 170].

Chilli. Four selections from Myliddy were resistant to the leaf-curl complex.

2341 **Annual Report of the Department of Agriculture, Nyasaland, for the year 1957/58 : Part II.** 1959 : Pp. 155.

Maize. The series of top-cross yield trials conducted during the past six years has provided satisfactory information on the general combining ability of locally developed inbreds. Two trials of double and single hybrids showed three Mexican strains (H501, H505 and SLP20.66B) and the Southern Rhodesian inbred N2656 to be outstandingly good as combiners with local lines. A notable feature of trials conducted at five centres was the success of five hybrids and two synthetics, developed from combinations of local and introduced material. It is pointed out that it is a measure of the progress attained through breeding that the open-pollinated variety Namalenga, once almost the top yielder, is now below the mean in yield at all stations. For overall combination of yield and quality, however, this variety remains the best for general use. To obtain material for the production of further synthetics, crosses were made among 29 varieties, synthetics and hybrids which have shown desirable characteristics during the past five years.

An extensive programme of crossing and back crossing to improve the resistance of breeding material to leaf blight caused by *Helminthosporium turcicum* (*Trichometasphaeria turcica*) continued. Sources of resistance used for the first time had been introduced from Mexico, Colombia and Guatemala. The yield given by Mlonda, an F_1 synthetic resistant to leaf rust (*Puccinia polysora*), was satisfactory, particularly at Makaga, for which area it was developed. Its grain quality is especially good. It is hoped that the reduction in vigour and yield to be expected from the next generation will not be great, because of the complex pedigree of Mlonda, comprising Makanga Selection (open-pollinated local variety), the local inbreds R3363 and L3198, the East African open-pollinated varieties Muratha and K8, SLP20–4A (Mexican inbred), Mexican Hybrid (L11.123–2–1–8 x Coahuila 8–56A–4–2) and "Col 2" from Colombia. The component inbreds of Mlonda were selected to improve their resistance to leaf blight. Crosses between high yielding strains and leaf-rust resistant lines produced by the East African Agriculture and Forestry Research Organization were tested at two centres. Combinations having the highest yield and acceptable quality will form the basis of further work on rust resistance.

Cotton. Albar 637 is being multiplied to replace CLB [cf. XXIX, 4107]. Single-plant selections made in 1957 from A637 and related Albar strains were graded for resistance to jassid and bacterial blight, about 80 being retained. Albar 49 crosses were included in

full-scale variety trials. As in 1957, they showed improvement over CLB and one or two appeared to be in the same class as A637. The F_1 of Albar 51 x (MU8 x BP52 x BP52) and other Albar 51 crosses made last year was raised.

Tea. Mother bushes were selected for drought resistance, yield and other characters and will be propagated for further field testing of clones in comparison with seedling progenies from various African seed sources. About 1500 seedling selections were planted out. Six seedling types were chosen and propagated vegetatively as the first step in the study of juvenile characters in relation to the mature bush. Selection was based on the size, shape, position on the stem and colour of the leaf and cuticle thickness.

Tung. In the collection of crossed and selfed type–B seedlings of *Aleurites montana,* some trees are cropping well enough to form a nucleus of mother trees for future propagation. Selected F_1 seedlings from *A. montana* x *A. fordii* were planted out; they are generally less vigorous than *A. montana* seedlings.

2342 **Report of the Secretary to the Federal Ministry of Agriculture, Federation of Rhodesia and Nyasaland for the year ended 30th September, 1958** (1959) : Pp. 215.

Wheat. Breeding at the Agricultural Experiment Station, Salisbury, S. Rhodesia, continued [cf. 193]. Strains selected during the previous year at Salisbury and Sabi for rust resistance gave a satisfactory performance at Sabi. Assuming no future breakdown in resistance, stem rust is thus no longer considered to be a limiting factor at Sabi.

Maize. The present position and future prospects of hybrid breeding are assessed [cf. 193]. The first bulks of male-sterile seed of four inbreds, two of which are N3–1–4–9 and N3–2–3–3, were obtained. N3–2–3–3 is the inbred seed parent of the single cross most widely used as seed parent in producing commercial double hybrids. At the Matopos Research Station, emphasis is being laid on the production of synthetics in the belief that they will be more suited than hybrids to the areas with lower rainfall. Selections were made from the open-pollinated varieties Teko Yellow, Kroonstad Robyn and American White Flint. Top crossing to evaluate general combining ability was carried out on both white and yellow inbreds. Intervarietal crosses and conversion of the white Rhodesian Hybrids I, VI and VIII to yellow types also received attention. Work in connexion with the development of hybrid maize continued at the Sabi Valley Experiment Station. Canary Isles dwarf material and South American rust-resistant lines were further inbred. Streak-resistant lines were introduced from the Union of South Africa.

Cotton. At the Gatooma Research Station, S. Rhodesia, progress is being made in back crossing and selecting for resistance to jassid and bacterial blight and other characters in progenies of: (1) selections from Albar 51 strains, particularly Albar 637; (2) crosses between Albar 51 strains and derivatives of MU8A x $BP52^2$; (3) crosses of BP52 lines carrying B_2B_6 with MU8A, Albar 51 or G52/36; and (4) crosses between BAR4/18 (*Gossypium barbadense,* B_2B_6) and *G. hirsutum.* Albar 637 [cf. 2905] has shown high yielding capacity, bacterial-blight resistance and better lint quality than U4. Seed immaturity may however be a defect. The variety has been initially bulked and included in district trials. Some strains from (2) were taken forward from progeny to small-bulk trials. Selection within U4 strains will probably be reduced in scale since marked improvement in lint quality is not expected and their bacterial-blight resistance is inferior to that in other cottons, such as the Albar strains. G52/36, a selection from the commercially grown 9L34 and a direct descendant of U4, is not to be issued on account of its lack of fibre maturity.

Annual Report of the Entomological Society of Ontario, 1957. 1958 : **88** : Pp. 86.

2343 *Auclair, J. L. Developments in resistance of plants to insects.* (*pp. 7–17*).

The subject is reviewed briefly with particular reference to recent developments in the study of antibiosis.

2344 *Robertson, J. G. The mechanism of evolution: a summary.* (*pp. 22–30*).

This brief survey of evolutionary theory considers the chromosome basis of inheritance, the nature of the gene, gene frequency, heterosis, genetic homeostasis and the present status of Lamarckism.

Report of the Horticultural Experiment Station and Products Laboratory, Vineland Station, Ontario, 1957 and 1958 : Pp. 161.

2345 *Dickson, G. H. Vista, Venus, and Vic sweet cherries.* (*pp. 43–44*).

[Cf. 733].

2346 *Bradt, O. A. Peach breeding.* (*pp.* 45–49). Breeding during 1939–56 is reviewed, brief descriptive notes being given on (1) the more promising selections still under test and (2) the parentages of the 79 crosses effected and numbers of selections made.

2347 *Kerr, E. A. Viceroy and Vinered—early tomato varieties for the home and factory.* (*pp. 49–52*).

Viceroy was developed from Bounty x Rutgers and Vinered from Early Chatham x Rutgers. Viceroy is early and indeterminate, producing large red fruits with a fine flavour and "exceptionally meaty internal structure." It has a curly type of foliage which should not be attributed to disease. Vinered is determinate and very early, bearing rather small fruits which are however excellent in quality. Both varieties carry *u* for uniform ripening, derived from Bounty. Incidence of leather top is therefore reduced. The varieties are expected to be of most use in the cooler areas of Ontario and the north-eastern USA, not only for the domestic garden and fresh market but also for processing.

2348 *Kerr, E. A. V548, an emigrant greenhouse tomato with resistance to* Cladosporium *leaf mold.* (*pp. 52–55*).

The origin and characteristics of V548 are described. The variety has an ancestry similar to that of Vinequeen [cf. XXVIII, 3447] and has proved to be immune from *Cladosporium* leaf mould, not only in North America, but also in Europe and New Zealand. It has recently been released in the last country [cf. XXIX, 4591]. In Canada, Vinequeen is preferred because of its larger fruits.

2349 *Crowther, R. F. & Truscott, J. H. L. Variety tests of grapes for wine.* (*pp. 95–112*).

Detailed information on 34 varieties is provided.

2350 **Progress Report of the Experimental Farm, Brandon, Manitoba 1953-1957** : Pp. 67.

Barley. Parkland was distributed in 1957 [cf. XXIX, 361]. The high degree of loose-smut resistance possessed by Jet (CI967) has been transferred to hybrid fodder types having good yielding ability and kernel, head and straw characters. The majority are resistant to stem rust and seedling smuts. The best of these hybrids have been used in a project initiated to develop malting varieties highly resistant to loose smut. Montcalm, Parkland and Olli have figured as recurrent parents. Tests of derivatives of second back crosses for malting quality gave encouraging results. New sources of smut resistance have been crossed with hybrids having the Jet type of reaction, in order to combine different genes for resistance. The mode of inheritance and linkage relationships of these genes are being determined.

Brome grass. Progress was made in breeding a strain with reduced creeping-rooted habit, high percentage of leaf and good yielding ability.

Sweet clover. Introduced varieties and species are being tested in the search for resistance to sweet-clover weevil (*Sitonia cylindricollis*). Although 19 species have been screened, no dependable source of resistance has been found.

Pea. A disease caused by a *Pythium* species destroys the seed before germination is complete. A high degree of resistance was found in a local variety and some introductions, all carrying *A* for anthocyanin production. Resistance proved to be closely linked with, or due to, *A*, which also causes poor colour and flavour of green peas. The search for resistant types is being continued.

2351 **Progress Report of the Experimental Farm, Agassiz, British Columbia 1953-1957** : Pp. 47.

Oats. Lines and varieties now in use as disease-resistant parents include Rodney, Garry, RL1942 and derivatives of RL1942 x Ajax, (Santa Fe x RL1942) x Garry, Beacon x CI3843 and Garry x Mutica Ukraine. Lines developed at Agassiz have been employed as high-yielding back-cross parents in combination with some of the disease-resistant parents. Multiple crosses have been effected between the F_1s of high-yielding parents which are resistant to disease and lodging. Introduced parents have included Marne, Bambu II, Sisu [Courage] and Binder.

Barley. In spring-barley breeding for resistance to powdery mildew, use has been made of the Rabat type of resistance, with Vantage and Montcalm as the recurrent parents. As this programme neared completion, after seven combinations with the recurrent parent, new races of the pathogen capable of attacking Rabat appeared in the field. The final stages of selection for this type of resistance are therefore being completed in the greenhouse. Additional genes for resistance are being incorporated into Herta, which already carries at least one for resistance to some races. H–42 (Bolivia x Chevron), Modia (CI2483) and CI8828 are being used as sources of resistance. Olympia has been

crossed with highly disease-resistant derivatives of a cross of *Hordeum leporinum* x *H. vulgare* made at Ottawa. Further crossing with exceptionally winter-hardy varieties is planned. Winter-barley breeding has been initiated.

Raspberry. The characteristics being sought include (1) adaptation to wet soil, (2) resistance to root-rot fungi, (3) cold resistance and (4) high yield coupled with satisfactory processing quality. Agassiz 34 (Newburgh x Cuthbert) survived a sudden cold spell of unprecedented severity in November 1955 almost unscathed. Agassiz 14 and Agassiz 19, respectively selected from open-pollinated stock of Winona and Ottawa 271, had fairly good hardiness. All three seedlings are especially promising in respect to the main aims of the project. A search is being made for material resistant to the virus vector *Amphorophora rubi*. Reported to be aphid resistant, Lloyd George is being used in crosses.

Strawberry. Agassiz (Pathfinder x British Sovereign) was released for limited commercial trial in 1956. The fruits are as firm as those of British Sovereign, their large size being maintained throughout the picking season. Although slightly acid in flavour, they have good quality for freezing.

Broccoli. F_1 hybrids produced from inbreds have outyielded Northwest Waltham. Four different crosses at present under test, involving two ♂-sterile lines, have shown uniformity in maturity, considerable resistance to bolting and higher yield than Northwest Waltham. These inbreds can however be maintained only vegetatively.

2352 **Progress Report of the Experimental Farm, Lacombe, Alberta 1953-1957** : Pp. 43.

Wheat. Further work was carried out on developing varieties equalling or surpassing Saunders in earliness and satisfactory in disease resistance and other respects. Three hybrid selections were crossed with Reward.

Oats. The main aim is incorporation of the character of plump kernels in an early-maturing variety. The plump-kernelled variety Rodney, Eagle and early hybrid lines have been used as parents.

Barley. Olli, Gateway and Wolfe have offered sources of early maturity. In breeding for loose-smut resistance, Anoidium derivatives and, more recently, Brandon selections carrying the Jet type of resistance have figured as parents. Br. 3902 and Pirkka have been used in crossing for improved quality. Vantmore and other varieties have provided sources of scald resistance.

As reported elsewhere, differences in seed size have been found to be an important source of variation in plant development; they should be taken in account if selection on a single-plant basis is to be effective [cf. 17].

Red clover. The project on developing red clover resistant to northern anthracnose (*Kabatiella caulivora*) has resulted in three promising synthetics. Two are of Siberian origin, respectively consisting of 17 and 7 individual-plant selections. The third synthetic was derived from six resistant plants of Dollard.

Apple. Apple x crab seedlings displaying the greatest hardiness originated from crosses of Dr. Bill with Columbia, Osman and Heyer 12.

Cherry. *Prunus fruticosa* seedlings have proved to be almost 100% hardy; the main basis for selection will therefore be fruit characteristics. As the result of breeding initiated in 1949 to improve hardiness and fruiting ability in *P. tomentosa*, seven selections meriting further study have been produced.

Raspberry. Of the crosses received from the Experimental Farm, Morden, Man., Honeyking x Ottawa gave the highest percentage of hardy seedlings.

Strawberry. The most promising selections of crosses obtained from Morden originated from Valentine x Simonet 18, Pixie x Premier, Pixie x Evermore and Pixie x WA21.

Tomato. Breeding begun in 1948 to develop a variety for central Alberta was terminated in 1955 in favour of a cooperative project between experimental farms in the three prairie provinces and North-west Territories. As part of this project, back-cross lines from (Earlinorth x Morden BB3) x Earlinorth are under investigation.

2353 **Progress Report of the Experimental Farm, Beaverlodge, Alberta 1953-1957** : Pp. 35.

Oats. In breeding, emphasis is being laid on combination of early maturity with high yield, suitable kernel type and lodging resistance. Abegweit was crossed with Rodney and Garry.

Barley. Breeding included crosses to incorporate resistance to scald and loose smut, improved resistance to lodging and higher yielding capacity in Olli.

Apple. Seedlings of apple and crab selected during 1951–57 were derived from the following crosses: Heyer 12 x Rescue, Dolgo x Osman, Robin x Mantet, Columbia x Breakey, Heyer 12 x Trail and Columbia x Dr. Bill.

Strawberry. Premier and Northerner have been outstanding as parents, respectively transmitting vigour and high yielding ability.
Tomato. Early-ripening lines have been selected, the most promising being a yellow-fruited derivative of [(Farthest North x Fargo Yellow Pear) x Firesteel] x (Farthest North x Polar Circle). One to two weeks earlier than the recommended varieties, it has the ability to set fruit during cool weather. Selections from Earlinorth x Morden BB3 were back crossed with Earlinorth but the apparent linkage between earliness and small fruit size has not been broken.

2354 **Progress Report of the Experimental Farm, Nappan, Nova Scotia 1953-1957** : Pp. 47.
Oats. Breeding to develop strong-strawed, thin-hulled, midseason varieties resistant to diseases continued. While no varieties highly resistant to *Septoria avenae* (*Leptosphaeria avenaria*) have been found, some show a considerable degree of tolerance.
Barley. Progress has been restricted by lack of suitable parents, particularly with respect to root-rot resistance. Selection has been confined to crosses in six-rowed barley, which has a higher yield potential, although two-rowed varieties are frequently less affected by unfavourable conditions. Some two-rowed material is now being used in breeding to provide a wide basis for selection.
Timothy. Later maturity has been the main aim in breeding, to extend the period during which good quality forage may be harvested. Six synthetics later than Climax by at least two weeks have been developed by intercrosses of eight individual-plant selections in various combinations. The best synthetic equals Climax in recovery after cutting and dry-matter yield and is somewhat higher in protein content and lower in fibre percentage. The synthetics are to undergo tests in the USA and at other centres in Canada. Additional work is under way to determine whether the synthetics retain their good seed quality in later generations.
Lucerne. Selection for tolerance of excessively moist acid soil is receiving attention.
Swede. Progress has been made in developing hybrid strains combining good resistance to club root with acceptable quality and other desirable features.

2355 **Progress Report of the Experimental Farm, Charlottetown, Prince Edward Island 1953-1957** : Pp. 40.
Oats. Progress has been made in transferring the resistance to *Septoria avenae* (*Leptosphaeria avenaria*) possessed by some commercially unacceptable types to a suitable variety. Introduced varieties with superior resistance to lodging are now being used as parents.
Barley. In breeding for resistance to jointworm (*Harmolita hordei*), the most promising lines have been developed from Montcalm x Mianwali. The latter variety, an introduction from India, was the source of resistance.

2356 **83rd Annual Report of the Ontario Agricultural College and Experimental Farm, 1958** : Pp. 98.
Strawberry. In four of the six progenies studied, the everbearing character depended on complementary gene action. Three of the four lines appeared to be allopolyploids. The fourth line is described as an "autoallopolyploid with three genomes in the autoploid condition."
Tomato. Plants homozygous for d^m (dwarf modifier) have short and thick main stems. This genotype did not however prove superior in germinative capacity in cold soils.

2357 GUNDY, L. J.
Use of paper forms in performance testing.
Agron. J. 1959 : **51** : p. 751.
Information is provided on the paper forms which are used in variety testing at the Hoblitzelle Agricultural Laboratory, Texas Research Foundation, and which make copying plot data from field books to work sheets unnecessary.

2358 **Annual Report of the Massachusetts Agricultural Experiment Station, 1956-1957** : Bull. No. 503 : Pp. 63.
Maize. The new hybrid (Pa 54 x Pa 11) x (Q 83y x NY 3) was assigned the north-eastern regional number NE420. A few days later than Mass. 63, it is especially suitable for both grain and early silage production.
Cocksfoot. The tall, leafy, late-maturing strain developed is more satisfactory than early commercial strains for mixtures with lucerne or Ladino clover.
Carrot. In selection of Waltham Hicolor, progress has been made in securing better uniformity in core colour, a higher percentage of first-grade carrots and improved uniformity of shape combined with shorter roots suitable for packaging.
Cabbage. A small, second-early dark green type adapted for close spacing has been developed.
Lettuce. Progress was made in producing a more uniform and better adapted Iceburg type.

Tomato. The F_1 hybrid Red Jet was introduced. In work on trellis tomatoes, resistance to cracking and late maturity proved to be linked.

Sweet corn. Incorporation of cytoplasmic male sterility and restorer genes into several inbreds is well under way.

2359 **70th and 71st Annual Reports of the South Carolina Agricultural Experiment Station for the year ending 30 June, 1957** (1958) : Pp. 64 **and for the year ending 30 June, 1958** (1959) : Pp. 68.

Sorghum. Preliminary results from the open-panicled grain hybrid SC1 were encouraging.

Potato. USDA B73–3 showed promise of being more satisfactory than Sebago, chiefly because of its earlier maturity and freedom from internal discoloration.

Sweet potato. Carogold was released [XXVIII, 4421].

Tobacco. Selections with resistance to root-knot nematode and good yield have been developed but require further evaluation for smoking and chemical properties.

Cotton. Earlystaple (Coker Wilds x Tidewater Acala), with a fibre length of $1\frac{1}{4}''$, is earlier in maturity than other long-staple types and on the average the best strain of the variety has produced 76% of the lint yield of short-staple cottons. It has fairly high tolerance of *Fusarium* wilt and was selected under conditions of severe nematode infestation.

Cantaloupe. A constant-temperature growth chamber constructed at the Edisto Experiment Station makes it possible to test breeding material, particularly for disease resistance, all the year round.
Edisto was released [cf. XXIX, 3163].

Cucumber. Promising lines of the pickling type, combining resistance to anthracnose and mildew and powdery mildew, have been developed by crossing a selection from Associated Seed Growers and PI197087 from India and back crossing to the former. Increase of one of the lines, showing superiority in preliminary processing tests, has already been initiated. A type of male sterility suitable for use in hybrid production was discovered in a pickling line during 1956. The mutation responsible has been transferred to a slicing type. The first small-scale production of hybrid seed of pickling cucumber will be attempted in 1959 but further inbreeding to secure uniform lines is required before hybrid seed of the slicing type can be developed.

Tomato. Progress has been made in breeding lines highly resistant to root-knot nematode. Resistance was derived from certain Hawaiian varieties which in turn had inherited resistance from an unspecified wild tomato.

2360 **Annual Report of the University of Florida Agricultural Experiment Stations for the fiscal year ending June 30, 1958** : Pp. 411.

Biochemical genetics. Induction of tryptophane or lysine-requiring mutants of *Arabidopsis thaliana* by irradiation is being attempted.

Oats. In tests of advanced breeding lines, 21 lines produced more forage than Floriland and 71 more grain than Seminole. In a preliminary test, long-panicled lines yielded more grain than short-panicled. Data for the first year were collected from an experiment designed to secure estimates of the additive variance and genotype x year and genotype x locality variance for forage and grain yields. In another experiment, progenies were increased to provide material for determining epistatic variance. Two lines highly susceptible to grey speck due to Mn deficiency were used in crosses made for studying segregation of this character.
Equal numbers of progenies from neutron-treated and control populations of Floriland were selected for two generations, all abnormal types being eliminated. In the third year, 324 lines from each population were tested for yield in lattice designs. The genetic variance of the irradiated population was 6·6% higher than that of the control, indicating that beneficial mutations had been induced in polygenes. Lines in each population were recombined to initiate a new cycle for testing the effectiveness of inducing polygenic mutation. Some selections from irradiated material of Floriland were resistant to crown-rust race 290 and others resistant to race 264 [cf. XXIX, 2556–7]. Straight awn was dominant in this material, its segregation being aberrant. The frequent occurrence of chromosome irregularities may explain the abnormal inheritance. "Sucker mouth" was recessive and normally inherited.
Mutants resistant to *Helminthosporium* (*Pyrenophora*) *avenae* were selected from the susceptible variety Fulgrain and should be useful in breeding. They have the same resistance to certain races of crown rust as their parent.

Rye. Neutron irradiation of Gator led to a marked decrease in genetic variance for yield. Beneficial polygenic mutations were probably

induced, as in the case of oats, but selection may not have increased yield because the effects of deleterious mutations may have been stronger in this diploid crop than those of beneficial ones. Seed was γ irradiated in an attempt to incite mutation in alleles for self sterility. Material from seed receiving 3000 r. was much more self fertile than that treated with any other dose; further work is required to determine whether mutations were induced.

Selected lines from an experiment on the effectiveness of recurrent selection for low and high forage yield were recombined to initiate a further cycle. Inbreeding continued. In breeding to produce male sterility by transferring the chromosomes of rye to wheat cytoplasm, the BC_1 showed 9·5% fertility, as against 1·1% in the F_1. Chromosome numbers in the BC_1 ranged from 21 to 28.

Maize. Studies to determine the relative effectiveness of the following three methods of recurrent selection for increased hybrid vigour were continued: (1) selection for specific combining ability, using an inbred as tester, (2) selection for general combining ability, with a composite having a wide genetic base as tester, and (3) selection of inbreds for vigour *per se*. Significant advances in yield have resulted from each method during three cycles of selection over a six-year period but no trend indicating that one method is appreciably more effective than another is apparent. At least two additional cycles are to be effected before final evaluation.

Progress was made at the Everglades Station in selecting dent maize for resistance to *Helminthosporium turcicum* (*Trichometasphaeria turcica*). Most of the 133 strains introduced from Africa were highly resistant to this disease. Flint varieties were more resistant to earworm (*Heliothis zeae*) and rice weevil (*Sitophilus oryzae*) than semiflints which in turn were more resistant than dents. Francisco Flint, Cueto 56 and Tiquisate were most resistant to earworm; the first of these varieties was also the most resistant to rice weevil.

Barley. An attempt to induce mutations by exposing the growing point of the embryo to ultraviolet rays is under way.

Forage grasses. In pearl-millet improvement, the value of interspecific hybridization is being explored. Inbreds are also being developed, use being made of a cytoplasmic ♂ sterile line in crosses. Pangola grass (*Digitaria decumbens*) is being treated with colchicine to induce chromosome doubling as a means of securing viable pollen. Vegetative cuttings of this species are to be exposed to Co^{60} irradiation. Introductions of *Digitaria* spp. are being grown for evaluation as possible parents.

Lupin. Over 800 introduced lines, varieties and species were screened for reaction to bean yellow mosaic virus in the greenhouse. Two entries, G–619 and G–180, representing unidentified species, had the desired hypersensitivity. Crosses between these two lines and the sweet yellow lupin Weiko III are being attempted. Selections of bitter blue lupin apparently resistant to *Botrytis* sp. were crossed with other blue-lupin lines. Since brown spot due to *Pleiochaeta setosa* has recently been the most serious disease affecting both blue and yellow lupin, screening of introductions and selections for immunity or resistance was initiated. A macromutant of yellow lupin was discovered [cf. 2789].

Crotalaria. Irradiated material of *C. spectabilis* is being examined for possible beneficial mutations.

Sweet pepper. P11 and P34 both proved to be resistant to at least some strains of tobacco mosaic virus (TMV), tobacco etch virus (TEV) and potato virus Y (PVY). Resistance to TEV in both lines was tentatively attributed to a single recessive gene. Another recessive gene, possibly closely linked with that governing TEV resistance, determined resistance to PVY. TMV resistance in both lines "was effected by the presence of the dominant gene, in at least the heterozygous condition, of a partial-dominance allelic series."

Castor oil plant. Some progenies of the BC_3 of Cimarron were highly resistant to *Xanthomonas ricinicola* when artificially inoculated and also resistant to *Alternaria* leaf spot in the field.

Tung. Selections G37, M1 and G53 and *Aleurites fordii* crosses with F174 and F36 in the parentage displayed much more resistance to *Cercospora* leaf spot, although bearing larger fruit crops, than the surrounding trees.

Sugar cane. Tests were carried out on several series of seedlings produced in the project on breeding cane for sugar, syrup, chewing and forage at the Everglades Station.

Tobacco. Encouraging results were obtained from screening for nematode resistance in flue-cured lines having multiple resistance to black shank, bacterial wilt and *Fusarium* wilt.

In work on cigar-wrapper tobacco at the North Florida Station, an introduction from the Dominican Republic highly resistant to black

shank is being used in breeding. The black-shank resistant variety Magnolia was released [cf. 645]. Some derivatives from crosses between black-shank resistant lines and blue-mould resistant parents exhibit resistance to both diseases.

Hibiscus. In an attempt to combine resistance to *Meloidogyne* with desirable plant type, the resistant amphidiploid *H. cannabinus* x *H. eetveldianus* was back crossed to the former species, but so far only one apparent back-cross plant has resulted from pollination of 560 flowers. Preliminary screening of the Salvador variety of *H. cannabinus* indicated scope for selection for nematode resistance.

Initial results from an analysis of ten pure lines and all combinations between them yielded information on combining ability, heterosis and dominance and suggested that it would be better to concentrate on production of synthetics than of pure lines.

Sansevieria. F_1 hybrids of *S. trifasciata* x *S. deserti* gave much higher yields of fibre than the parents in 1957 but their regrowth is inferior to that of the better parent, *S. trifasciata.* Some back crosses to *S. trifasciata,* however, have retained most of the vigour of the F_1 and appear to be superior to this generation in regrowth and plant type and equal to it in tolerance of cold and disease. The F_2 hybrids show a considerable amount of phenotypic segregation but are not as vigorous as the F_1 and back crosses.

Peach. In crossing, emphasis was laid on combinations between seedlings with low chilling requirement and northern or western commercial varieties. Because of the complex quantitative inheritance of chilling requirements and quality, it is expected that several generations of breeding will be necessary to secure fully satisfactory varieties.

Citrus fruits. Varieties and relatives of citrus fruits were screened for resistance to *Radopholus similis* [cf. XXIX, 681–3].

Groundnut. Of the new hybrid lines under study, Florida 392, involving Florispan Runner and Jumbo Runner in its pedigree, is being further selected for seed quality and uniformity.

Rubus. Resistance to diseases, including double blossom, and other desirable features have been combined in blackberries well-adapted to the Gainesville and Sanford areas. An F_2 selection of Regalness x *Rubus trivialis* was ready for harvesting about a month before local wild blackberries. It was also several pickings ahead of Advance and surpassed this variety in fruit size.

Blueberry. Improvement included selection of hybrids apparently derived from crosses between the diploid native species *Vaccinium darrowi* and northern highbush blueberries, for early ripening, colour and medium fruit size.

Grape. Tetraploidy was induced by colchicine in bunch-grape selections.

Celery. Breeding for resistance to *Cercospora apii* and bolting and for other improvements continued.

Endive. An attempt is being made to combine vegetative vigour of an off-type found in a commercial lot of fringed endive with the broad-leaved character of Florida Deep Heart. Selection will also be made against midrib coloration.

Cantaloupe. Selections developed at the main station include a line of Honeydew, with considerable resistance to downy mildew (*Pseudoperonospora cubensis*). Fla. 57 has shown multiple disease resistance, productivity and good quality at the Central Florida Station. Two hybrids involving a ♂-sterile line gave a good performance.

Water melon. The USDA line 51–23B was again selected for resistance to *Fusarium* wilt.

Tomato. Indian River, notable for its resistance to grey wall and *Stemphylium solani,* was released [cf. XXIX, 3163]. Of the stocks giving encouraging results at the Gulf Coast Station, 213–2 CAStMW and 240–4 CAStMW are resistant to tobacco mosaic virus. Repeated testing of PI128887 has indicated that several plants of this accession are resistant to mild and severe strains of potato virus Y; single-plant selections are being made to establish pure lines.

Bean. At the Sub-tropical Station, McCaslan x Florigreen is yielding selections from which it is expected that a rust-resistant pole bean combining the better features of both parents will be isolated. Snap-bean breeding to develop white-seeded Tendergreen and Blue Lake types with bush habit continued.

Lima bean. Promising selections have been produced. Vegetatively propagated material representing a cross between Fordhook and PI201283 (hypogeal *Phaseolus* sp.) is considered to offer most promise as a parent for introducing the character of hypogeal emergence into Lima-bean varieties with large cotyledons.

Cowpea. Improved Black Eye and other types are under study.

Soya bean. It is believed that sources of field

resistance to root-knot nematode (*Meloidogyne* sp.) suitable for breeding have been found. A minimum of four pairs of genes is responsible for the difference in seed size between CNS–4 (14 gm./100) and Biloxi (26 gm./100), with either geometric gene action or partial dominance of genes for small size.

Garden pea. F_2 selections were made from crosses designed to introduce the characters of larger and looser pods into Fla. 2 and Emerald lines.

Sweet corn. Progress has been made at the Everglades Station in developing hybrids combining resistance to *Trichometasphaeria turcica* with acceptable ear type and productivity. Analysis of a line homozygous for the factor shrunken–2 showed that the ears varied widely in sucrose content. Modifiers must therefore be present, precluding the use of straight back crossing to incorporate the desired sugar retention associated with the gene into normal lines.

2361 **Director's Annual Report of the Chilean Agricultural Program, August 1957-July 1958** : Rockefeller Found., NY : Pp. 42.

Spring wheat. The new variety Orofen has an excellent yield. It is derived from [(Newthatch x Marroquí 588) x (Kenya 9908 x Mentana)] x Frontana. It is resistant to stem rust. Several high yielding lines from the cross (Yaqui-Kentana sib) x Frontana are resistant to rusts and have strong short straw. A variety with maximum earliness is still needed.

Synthetic production is being continued; the varieties Quaderna and Florence-Aurore are being reconstituted to bring out resistance to stem rust.

Winter wheat. A large number of crosses have been made with the object of providing varieties with a broader genetic base for resistance to stripe rust. Breeding for stem and leaf rust resistance, earliness, strength of straw and quality is in progress and varieties used as progenitors in each line of investigation are tabulated.

A number of lines from the world winter-wheat collection have been selected and crossed with local regional varieties.

Lucerne. The production of a creeping-rooted type with a higher degree of winter productivity adapted to northern parts of Chile is the object of hybridization experiments.

Red clover. Selection of plants resistant to *Uromyces trifolii* is in progress. A variety showing resistance to the disease complex caused by soil organisms is being looked for.

2362 Rojas M., E.
Labor realizada por el programa de forrajes en la Costa—campaña 1957–58. (**Work carried out in the forage-crop programme for the coastal zone. Season 1957-58**).
Inf. mens. Estac. exp. agríc. La Molina 1959 : **33** : No. 380 : 19–21. (Mimeographed).

Oats. Forage varieties resistant to crown and stem rusts are undergoing trial.

Sorghum. A collection of forage and grain varieties is being maintained. Lines from the F_7 of Atlas x Short Kaura and the F_3 of Ellis x Sugar Drip are under study. Self-fertile lines of Sudan grass selected for resistance to rust and to Lima winter conditions are being maintained; derivatives of Greenleaf are distinguished by their fine sweet stems.

Sunflower. Selection for rust resistance and forage production is in progress in the F_4 and F_5 of crosses between Klein x (Sunrise x 953–102–1–1–22) and La Estanzuela x (S–37–388 x 953–102–1–1–22).

2363 Boza Barducci, T.
Problemas de la agricultura del Valle de Cañete. (**Agricultural problems in the Cañete Valley**).
Vida agríc. 1959 : unpaginated.

A survey of some of the main cotton varieties produced at the Cañete Experimental Station, Peru, since 1926 is included in this paper and recommendations are made regarding varieties suitable for different soil types or showing resistance to wilt. CÑ281–51 is a good variety and the new hybrid CÑ–H–222 shows great promise as an early-maturing cotton. Mention is also made of some of the best varieties of maize, potato, sweet potato and citrus fruits.

2364 **Director's Annual Report of the Colombian Agricultural Program, May 1, 1957-April 30, 1958** : Rockefeller Found., NY : Pp. 260. (Mimeographed).

Wheat. Hybrids giving the best performance are K.58–N x Fr, which is also moderately resistant to stem rust, and Fr x Fn–Y, which is resistant to stem rust and moderately resistant to stripe rust; 47 lines have a bread quality superior to that of hard red winter wheat.

Over 2000 crosses have been made using Frocor, Bonza, Menkemen and Gabo as recurrent parents. A new variety, Zipa 57, derived from the cross II–2809–2b–4b–3b–1t, Frocor x Bonza

sib is a good early variety and resistant to stripe rust.

F_2 lines derived from crosses of spring wheats with Japanese dwarf wheats and high-yielding French varieties are under trial. The release of two improved varieties yielding up to 30% more and maturing 4–5 weeks earlier than old native varieties is alluded to.

A collection of local wheats resistant to stripe rust is being made; most of these are susceptible to stem rust. Wheat rusts have been collected for race identification. Selections of differential varieties are being made to establish pure lines of each.

Oats. Selections from the International Oat Rust Nursery which are highest yielding are Andrew x Landhafer and Osage x Bonza-H.J./Santa Fe. The latter is resistant to stem rust, the former immune against crown rust.

F_2 lines have been selected for disease resistance, earliness and strength of straw. An F_5 line of the cross Canuck x Florida 167 - Landhafer has proved of good quality, has short stiff straw, and is early and rust resistant; its yield is comparatively low. Selections of forage-type oats have been compared for yield at tillering and at the milk stage, FR270–2B–Neosho giving the highest total yield of dry forage.

Maize. The most promising hybrids under trial are: (A. Theo. 197C–1 x Eto 81) x (Cub. 23–grating –2 x Ven. 1–1371C); (Bl. Mont. 9 x Cub. 2–5) x (Bl. Theo. 20A x Bl. Theo. 186B); (PTR. 605 x Ven. 1–42) x (Eto 25 x Cub. 2–1); (Eto bl. 245 x Eto bl. 282) x (Des. 2–29 x Eto bl. 2053); (L.1–grating –20 x Ven. 1–1–2–3) x (Nar. 33–grating –10A– x Eto 25A); and (Nar. 330–grating –10A–bx Cal. 301–grating –30B) x (Col. 2–76 x Eto 282). Synthetics are also being developed and the most promising are lines of Colombia 2. Back-cross programmes to improve ear length, maturity and grain type are in progress. The cream-coloured grain of the variety Eto blanco has been eliminated.

Inbred lines with resistance and high tolerance to *Diatraea* spp. have been developed. Inbred lines with resistance to *Fusarium* and *Diplodia* spp. have been identified. Vigorous hybrids and varieties such as Eto Amarillo have greater resistance to *Laphygma frugiperda* than the weaker lines. Lines are being checked for resistance to *Heliothis zeae*. Some Nariño 330 lines are exceptional in showing little damage to the grain in damaged ears.

Barley. The improved early variety Funza gives a yield of 47% more than old native varieties. It is susceptible to dwarfing disease and selected lines of Nariño are being used in breeding for resistance to this; a genetic study of the nature of resistance is in progress.

Over 5000 crosses have been made, and some of these have been back crossed with Funza, Bachué and Tequendama to incorporate genes for resistance to loose smut, stem rust, leaf rust, scald, leaf blotch and powdery mildew. The highest-yielding hybrid obtained was DC7 x Pocha - Research 821.

Rice. Breeding work is directed to transferring resistance to the virus disease hoja blanca from the short and medium-grain Japanese types to the better adapted long-grain varieties.

Imperial grass. Clones are to be collected which appear to show resistance to bacterial gummosis as a beginning to an improvement programme.

Ryegrass. La Estanzuela and PI162678 have been selected for breeding work, and plants have been selected for high forage and seed yield, persistence and rust resistance.

Sorghum. MN345 is drought resistant and yields well. It is outyielded only by Tift Sudan grass, which however gives a larger number of smaller cuts. Sudan grass plants selected for habit of growth have been selfed and the seeds planted for random pollination. The intercrossed seed obtained is to be compared with the variety Tift.

Sorghum plants selected for phenotype, yield and *Helminthosporium* and rust tolerance have been selfed, and the better progeny selfed again. Selected S_2 plants are to be crossed and the synthetic obtained evaluated.

Lucerne. Du Puits is most productive in cooler climates. In warmer conditions Williamsburg and Indian Common were the most successful varieties. A marked varietal difference has been found in the response to borax top dressing. Rhizoma produced 90–200% greater yield than other varieties tested under conditions of boron deficiency, whereas it was not the highest-yielding variety where borax had been applied.

Red clover. An improvement programme has been initiated.

White clover. Superior plants of several types have been selected and replicated clonally for intercrossing and progeny testing, and subsequently for the production of synthetics. Extended artificial illumination has been used to induce flowering in nonflowering types.

Berseem clover. Several varieties from the USA have been tested, and Chile 1748 has given the highest yields.

Potato. New hybrids are being multiplied and 50–57–67 has been specially selected, as being high yielding and adapted to excessive moisture,

although susceptible to attack by a leaf miner. The highest yielding hybrid yet obtained is 52–8–16. Hybrids are being classified for reaction to *Phytophthora infestans*. Several races of this fungus have been isolated but the reaction of differential varieties and different isolates of any one race varied to such an extent as to indicate a noticeable degree of genetic variation within the races. The hybrid Malinchense x (Colorada blanca x Colorada) appears to be nearly immune to *Liriomyza* sp.

Bean. Breeding work has been directed mainly towards disease resistance. The variety Algarrobo [Carob] was released in 1954; it is higher yielding than the older varieties but very susceptible to angular leaf spot. Varieties 133 and 138 have better disease resistance but are unsatisfactory in dry seasons. Several lines from the cross 138 (Sánchez x Estrada Rosado) have been selected for resistance to anthracnose. The first disease-resistant variety suitable for high altitudes is Diacol Nutibara, which has good yields and market qualities. Yield trials have indicated that the most promising line is 02019–1–2–2–3–M–M–M derived from Peru 5 x Algarrobo. Breeding work is in progress to produce a high-yielding, disease-resistant Sangretoro-type bean. Studies of variation in the variety Estrada Rosado have resulted in the isolation of several phenotypically distinct lines, and also of differences in rust resistance. The stored seed of line 143 appears to be especially resistant to *Zabrotes subfasciatus*.

Cowpea. Bolivar 17 is recommended for human consumption and has good seed colour and yields. Venezuela 12A is recommended for use as green manure.

2365 Heath, R. G.

Annual Report of the Department of Agriculture, Federation of Malaya, for the year 1956 (1958) : Pp. 115.

Maize. Three East African rust-resistant varieties have been imported for trial.

Rice. Variety trials are dscribed. Pure-line selection within 14 major wet paddy varieties is in progress. The variety Radin Kling may now be regarded as a pure line.

Data on F_2 and F_3 *indica* x *japonica* hybrids are given. The F_2 have been typically sporadic in flowering and partially sterile. Among F_3 lines, the back cross HC48 (Gimbozu [Silver Bonze] x Serendah Kuning) x Serendah Kuning was less conspicuously heterozygous and flowered more normally than others. Subsequent generations show greater vigour and elimination of early flowering, together with increase in straw strength in the F_5, many of which appear almost homozygous.

Among hybrids of local varieties Siam 29 x Banyak Anak and Nachin 11 x Siam 29 appear to be high yielding.

Some exploratory crosses between the wild rice *Oryza ridleyi*, which is relatively immune to stem-borer attack, and Siam 29 have been made. X_1 generation plants of Siam 29 have noticeably stronger straw than the parent type. Cytological study of the pollen mother cells of X_0 plants has shown various chromosomal aberrations. Where meiosis was unimpaired by irradiation, genes controlling seed viability were liable to be affected.

A satisfactory technique for inducing polyploidy has been achieved and some typically tetraploid grains of Siam 29 have been obtained.

Siam 29, which is highly photosensitive, and Radin Siak 34, which is less so, are being subjected to experiments in photoperiodism.

Tests of comparative susceptibilities of Malayan varieties to *Piricularia oryzae* are in progress.

Sweet potato. The best varieties, which give large yields of both tops and tubers, are: Samar Big Yellow, Eng Chai Cheng, Taiwan Fan See and Kang Kong 58.

Manila hemp. The variety Tangongon appears to be the best suited to Malayan conditions.

Cacao. Methods of yield recording in variety and selection trials are described. Progeny trials of Indonesian and Malayan Trinitarios indicate that both categories are yielding less than Amelonado. Upper Amazon progeny trials are described. Trees showing leaf-axil spots are lower yielding and probably Upper Amazon x Trinitario hybrids. Experiments to determine pollen compatibilities are in progress. Amelonado x Nanay hybrids are more vigorous and of greater mean girth than Amelonado controls. Progeny trials of Upper Amazon, Trinitario, Amelonado and Criollo hybrids are in progress, and data are given for relative heights and girths. The production of improved self-compatible clones of Trinitario by inbreeding and selection for Criollo-type beans and improved quality is in progress.

Oil palm. Breeding work is principally directed to the development of the dumpy and *tenera* types, and comparison of these with *dura* types is also being carried out. Yield data for Elmina palms and for dumpy hybrids are given. The genetics of the habit of the tall-dumpy palms is being studied and it appears that the former assumption that it was controlled by a non-dominant pair of simple allelomorphs is not correct.

Grapefruit. Variety GF5 Perlis is best for processing or eating.

Coconut. Trees have been selected with the intention of carrying out controlled pollination experiments. Observations on dwarf coconut indicate that self pollination is normal. Variety trials are in progress.

Pineapple. Clonal selections of three varieties are in progress. Other varieties have been imported and hybrid seed for use in breeding work is to be imported from Brazil. The relation of quality of fruit to chemical composition of the leaf, and so to fertilizers, has been studied. The variety Mauritius is superior to others in sugar and acid content. This and Sarawak produce better quality fruit than Selangor Green and Singapore Spanish under unfertilized conditions. When canned, Singapore Spanish had a slightly better flavour than Selangor Green. Mauritius had a good colour, but nothing else to recommend it for canning.

2366 Heath, R. G.
Annual Report of the Department of Agriculture, Malaya, for the year 1957 (1958) : Pp. 106.

Rice. There are good prospects of high-yielding material responsive to fertilizers among the advanced generations of *indica* x *japonica* hybrid progenies. The highest yielding was an F_6 plant in a Serendah Kuning x Asahi [Rising Sun] line. Short-term strains suitable for double crossing are being selected. A new series of crosses using Engkatek, Seri Raja, Radin Kling and Siam 29 as parents has been carried out with a view to producing new varieties with short term, strong straw and resistance to the physiological disease penyakit merah. X_2 progenies of Siam 29 show promise of resistance to lodging. Mutants have also been back crossed to Siam 29 and the resulting plants have retained the strong-strawed character of the irradiated plants. Some colchicine-induced tetraploids are reported. Several varieties are classed as immune to *Piricularia oryzae.*

Panicum maximum. Six strains imported from East Africa are under trial to compare their relative suitabilities for close planting and mechanical harvesting with local material.

Cacao. Amelonado continues to give higher yields than the Trinitario strains. The Indonesian variety Suzannasdaal appears to be the highest yielding of the Trinitario strains. The Malayan Near-Criollo Trinitario has outyielded Amelonado in 1957. Upper Amazon, over a period of 5 years, had shown a yield much superior to Amelonado. Clone trials are in progress. Amelonado x Nanay 32 hybrids are larger and higher yielding than Amelonado. Amelonado x Malayan Trinitario hybrids have pods intermediate between the parental types and appear to be self incompatible. Information on the value of P_0 clones for breeding purposes is being sought in a trial of (F_2 x P_0) Upper Amazon backcrosses.

Oil palm. Progenies of hybrids of dumpy *dura, pisifera* and short *dura* types are under trial.

Oil yields from different 20-year-old progenies of Elmina Serdang Deli dura palms are given and also for dumpy and semidumpy types.

Yields in other progeny trials and comparative yields on different soil types are also given.

2367 Hulpoi, N., Buzdugan, I. & Berţea, V.
Experienţe cu porumb, cartof şi grîu în incinta indiguită "Brăila-Dunăre-Siret". (**Experiments with maize, potato and wheat in the area defined by Brăila, the Danube and Siret**).
Lucrăr. şti. Inst. agron. Ion Ionescu de la Brad Iaşi 1959 : 45–87.

Varietal trials with the above crops are reported, special attention being paid to response to various fertilizer treatments.

2368 Walther Feistritzer 60 Jahre alt und 25 Jahre Züchter. (**Walther Feistritzer 60 years old and 25 years a breeder**).
Kartoffelbau 1959 : **10** : p. 223.

Dr. Walther Feistritzer 60 Jahre. (**Dr. Walther Feistritzer 60 years old**).
Saatgutwirtschaft 1959 : **11** : p. 299.

A brief mention is made of the achievements of this breeder who was responsible for the development of many useful cereal and potato varieties in Germany.

2369 Grebenščikov, I.
Ein Vergleich des Heterosiseffekts im "Fruchtgewicht" bei Kürbis und Mais. (**A comparison of the heterosis effect in the fruit weight in *Curcurbita pepo* and maize**).
Kulturpflanze, Berlin 1959 : **7** : 184–97.

The fruit weight of 28 crosses involving various forms of *C. pepo* is compared with that of the parents and the results of some diallel crosses are displayed graphically. On the whole the fruit weight of the crosses was not superior to that of the parents; only four crosses showed a heterotic effect. But in the 86 maize crosses studied, heterosis for cob weight was found in 68 cases. This difference was not due to differences in degree of inbreeding for this was similar for inbred parents of both crops and the

proportion of inbred parents used was greatest in the *C. pepo* experiment.

For heterosis in *C. pepo* hybrids, it seems that one parent should have a fruit weight 2–2·5 times greater than that of the other parent; with greater differences, heterosis is unlikely.

2370 Prakken, R.
Induced mutation.
Euphytica, Wageningen 1959 : **8** : 270–322.

In this review the following topics are considered: types of mutation; radiation and chemical agents as mutagens; and techniques for the production and selection of mutants in plant breeding. A bibliography of 789 titles is appended.

Isotopes in Agriculture. Proceedings of the Second United Nations International Conference on the Peaceful Uses of Atomic Energy held in Geneva 1 September - 13 September 1958 : **27** : Pp. 455.

2371 *Ouang* [*Wang*], *T. Y. & Chang, W. T. Mutations in rice induced by X radiation.* (*pp. 223–26*).

[Cf. XXIX, 4689].

2372 *Sarić, M. R. The dependence of irradiation effects in seed on the biological properties of the seed.* (*pp. 233–48*).

The paper includes an account of studies of the effects of X irradiation of the seeds upon growth in relation to (1) polyploidy in rye and *Triticum* spp. and (2) hybridity in maize. As already reported [cf. XXVIII, 2897], tetraploid Petkus rye was more resistant to irradiation than the diploid of this variety. Effects of radiation were not influenced by natural degree of polyploidy in wheat. Resistance may be specific for each variety. Thus, within *T. vulgare* var. *ferrugineum*, Golden Cross was more susceptible to irradiation than Ardito. Tests on additional material of maize [cf. XXVIII, 4142] revealed that inbreds differ in resistance and that both single and double hybrids are more resistant than inbreds.

2373 *Caldecott, R. S. Post-irradiation modification of injury in barley—its basic and applied significance.* (*pp. 260–69*).

[Cf. 2470].

2374 *Lefort, M., Duranton, J., Galmiche, J. M. & Roux, E. Genetic, cytological and biochemical study of a chlorophyllous mutant of tomato of the* xantha *type obtained by irradiation of seeds.* (*pp. 270–74*).

The recessive *xantha* mutant dies at the end of two weeks, when the seed reserves are exhausted. The mutant may however be maintained by grafting on normal tomato. Grafting did not alter the phenotypical effect of the mutation on chloroplast structure. As indicated by electron-microscopic examination, chloroplasts in mature leaves of the mutant lacked the lamellation characteristics of those in normal leaves and corresponded structurally to very young chloroplasts. Deviations in carbon metabolism, detected in a study of C^{14} incorporation, were mainly attributable to the abnormal structure of the chloroplasts. It is suggested that, "when the gene has retarded the synthesis of pigments, lamellation of the plastids can no longer occur normally because the molecules of chlorophyll and the carotenoids are insufficient in number. It is also conceivable that the gene is active on the level of the synthesis of the lipoprotein macromolecules necessary for the building up of the lamellas, and that it is no longer possible for the pigment molecules to be fixed on a structure whose organization could not be affected." [Cf. 875].

2375 *Masima* [*Mashima*], *I. & Kawai, T. Mutations of rice induced by radioisotope* P^{32}. (*pp. 293–98*).

Dormant or germinating seeds of Norin 8 [Ministry of Agriculture and Forestry 8] were allowed to remain for two weeks in solutions of $Na_2HP^{32}O_4$. The treatment induced a high percentage of chromosomal aberrations in the R_1 plants and a high frequency of mutants with respect to qualitative and quantitative characters in subsequent generations. Tentatively, it was possible to detect mutations affecting quantitative traits in the R_4 and R_5, and to distinguish such mutants clearly in the R_6 and R_7. Testing descendants after the fourth generation by the pedigree method may therefore offer the best means of recognizing mutations in quantitative characters of agronomic significance. Mutants of this type usually showed simultaneous variations in several characteristics, some of which had undergone an increase and others a decrease. With 283 fertile, true-breeding R_4 and R_5 mutant lines as the initial material, some promising derivatives resulting from selection for yield have been secured which in the first two years of field trials have almost equalled the parent variety in productivity, while possessing such features as short culms, long ears, dense ears or late heading. Further trials are to be carried out in the hope of obtaining a line of immediate value or material for hybridization.

2376 *Mohsin Abbas El Didi. The induction of monosomics and deficiency-duplications in* Gossypium hirsutum *by irradiation of seed.* (*p. 305*).

Monosomics and translocation heterozygotes were induced in *G. hirsutum* by exposing germinating seeds to 1200 r. of X rays. The resulting three monosomics contained $24_{II} + 1_{III}$. The characteristic configurations of a translocation heterozygote at metaphase I were (1) a closed ring, if both breaks had been near the centromere, (2) a closed bivalent with an attached chain of two chromosomes (2B–1 type), if one break occurred near the centromere and one near the end of an arm, and (3) two bivalents, separate or attached, if both breaks took place near the end. Upon outcrossing translocation heterozygotes to normal lines, normals, translocation heterozygotes and deficiency-duplications were obtained. Several of the complexes differed sufficiently in chromosome size and length of the interchanged arms to permit identification of the heterozygote and some of the deficiency-duplications at metaphase I. Recovery of viable deficiency-duplications from translocation heterozygotes through the megagametophyte proved to be the rule. In some, but not all, of the progenies, chromosomal aberrations caused phenotypic abnormalities. Loss of a centric chromosome carrying *C* resulted in the appearance of "cup leaf" in a progeny heterozygous for the recessive allele. It appeared that transposition of Cr^D to a point "near the heterochromatin" caused instability in its expression.

2377 *Bora, K. C. & Rao, N. S. Experience with rice* (Oryza sativa) *on the induction of mutation by ionizing radiations.* (*pp. 306–13*).

Reporting investigations carried out at the Atomic Energy Establishment, Trombay, India, the authors deal principally with a study of the cytogenetic effects of X irradiation, in which seeds of China 45 were used. X_1 plants from seeds exposed to up to 75,000 r. were normal in appearance, although initially slow in growth. An X_2 was raised from seeds from an individual in which 30% of the PMCs had hexavalents and 65% quadrivalents, the remaining 5% being normal. The X_3 of 22 lines showed a wide range of variation, characters such as seed sterility, *albina* seedings, dwarfing, time of flowering and grain dimensions appearing or being altered. Since no phenotypic evidence of a position effect was obtained, phenotypic changes in the X_2 and X_3 may be attributed to duplications and deficiencies resulting from translocation. The effects of translocation and subsequent duplication-deficiencies noted could be broadly grouped as follows: (1) the appearance of contrasting changes due to deficiency and duplication, e.g. earliness and lateness, (2) loss of inhibitors through deficiencies and (3) in relation to segregation of multiple factors. Heterozygous deficiency for a segment carrying *Ir*, an inhibitor of *Kl* for round grain, is held to be responsible for X_3 segregation for long-grained : round-grained plants in a 3 : 1 ratio, the X_2 parents having the genotype *Ir KlKl*. X_3 segregation ratios of 1 : 63 and 1 : 3 for *albina* : normal plants are interpreted as follows. Assuming that three gene pairs are involved, normal plants may have the constitution $W_1W_1W_2w_2W_3w_3$. Heterozygosity and homozygosity for a deficiency of a segment carrying W_1 would respectively result in the two ratios given. Finally, it is mentioned that, according to a study of translocation heterozygotes in several varieties, plants carrying translocations are indistinguishable from normal ones and no relationship exists between the presence of translocations and sterility. While some plants with one or two quadrivalents were practically sterile, an individual of Geb 24 with translocations involving 16 chromosomes was fully fertile, although its X_3 grains were poor in germinability. The remainder of the results reported were derived from seeds of Ptb–10 exposed to thermal neutrons; the data given are mainly on the N_1.

2378 *Bora, K. C. Comparative effects of varying doses of X rays and fast neutrons on the growth, development and induction of cytological changes in tetraploid and hexaploid wheat.* (*pp. 314–20*).

From a study of the 6*x* wheats Kemphad and Niphad and 4*x* Jaya it was concluded that a definite relationship cannot be established between ploidy, radiosensitivity and RBE.

2379 *Natarajan, A. T., Sikka, S. M. & Swaminathan, M. S. Polyploidy, radiosensitivity and mutation frequency in wheats.* (*pp. 321–31*).

Seeds of *Triticum monococcum* 'Japanese Early', *T. dicoccum* 'Khapli' and *T. aestivum* 'C59' and 'NP809' were treated with X rays, fast neutrons, P^{32} or S^{35} at the Indian Agricultural Research Institute, New Delhi. No strict correlation between chromosome number and radiosensitivity, as indicated by germination and survival,

was detected. Analysis of R_1 chromosome aberrations showed that sensitivity per unit chromosome length was (1) identical in all species in the case of X irradiation, (2) identical in the $2x$ and $4x$ varieties but significantly different in $6x$ wheat in P^{32} treatments, and (3) significantly different in all three species with fast-neutron bombardment. Differences in rate of absorption of P^{32} may be one of the factors influencing (2). Compared with $2x$ wheat, the $4x$ and $6x$ species had more breaks as the result of the same dosage of fast neutrons than could be accounted for by the differences in total chromosome length; these disparities in genome sensitivity are regarded as being due to type of radiation rather than to differential sensitivity. The $2x$ and $4x$ wheats were phenotypically highly stable, giving rise mostly to chlorophyll mutations in the R_2. A wide range of mutants for physiological and morphological characters, however, appeared in the R_2 of *T. aestivum*, the highest frequency being obtained from S^{35} treatment. In the last-mentioned species, the absence of chlorophyll mutations from all X-ray and radioisotope treatments and their appearance when the seeds were exposed to (1) X rays after pretreatment with ultraviolet rays or presoaking in water or (2) fast neutrons suggested that in $6x$ wheat specifically stable genes for chlorophyll production may be present which are unaffected by high doses of X rays. Several unlinked genes may control chlorophyll development in *T. aestivum*.

A high proportion of the mutations affected ear characteristics. The same types of mutations were induced by different radiations, although there were slight differences in relative frequencies. Chimeras also appeared in the R_2, particularly from radioisotope treatments. Such chimeras owe their origin to nondisjunction of isochromosomes during mitosis prior to initiation of some of the ear differentials. R_2 haploids were also obtained from P^{32} and S^{35} treatments. The early, stiff-strawed and fully bearded mutants of NP809 and stiff-strawed stem-rust resistant mutants of C591 are of economic interest.

Data on a bearded mutant induced in NP809 ($B_1B_1b_2b_2hdhd$) showed that it could have been caused by a cryptic deletion at locus B_1. The following awn types in the fully bearded variety C591 have been obtained: completely beardless (groundnut oil treatment) [cf. 2509]; tipped condition (fast neutrons P^{32} and S^{35}); reduced awns (P^{32}); and coloured awns. The genetics of the beardless mutant is discussed [cf. *loc. cit.*].

The effect of ultraviolet pretreatment on the yield of X-ray induced mutations was also investigated [cf. 1418].

The suitability of bread wheat for mutation breeding, in contrast to Einkorn, is explicable by supposing that polyploidy confers on the former the advantage of viability in the presence of even drastic genic and chromosomal alterations. Possibly the marked difference in the frequency of mutants affecting vital characters in *T. dicoccum* and bread wheat may be explained by assuming that in the former the duplicate factors relate to growth and metabolic processes and that the species is a functional diploid as regards most of the chief phenotypic characteristics, mutations in which are not tolerated. In bread wheat, genome D from *Aegilops squarrosa* apparently brings in many distinguishing factors, whose loss or alteration caused phenotypically detectable changes. Segregates in the R_2 often resemble those found in crosses between bread and emmer wheats, and several features associated with genome D, ordinarily masked by epistatic genes present in genomes A and B, may also be unmasked by the action of mutagens. During the evolution of *T. aestivum*, duplications for various genes concerned with basic metabolic processes seem to have been lost, with the result that the $4x$ and $6x$ wheats behave similarly with respect to survival in radiation experiments. A considerable homogeneity between genomes B and D in such basic factors is therefore implied, and the hypothesis that genome B also belongs to a species of *Aegilops* thus appears highly plausible.

2380 *Sen, B., Joshi, M. C. & Srivastava, S. M. Effect of ionising radiation on V.L. 13 wheat.* (*pp. 332–34*).

Seeds of VL13, an F_1 selection of a cross made between NP4 and Frondodo* at the Vivekananda Laboratory, Almora, India, were subjected to thermal-neutron bombardment by means of facilities in the USA. R_3 lines were obtained which outyielded untreated VL13 by 25% or more and were desirable in other respects.

2381 *Sparrow, A. H. & Schairer, L. A. Some factors influencing radioresistance and tumor induction in plants.* (*pp. 335–40*). [Cf. XXIX, 4695].

* Frondoso?

2382 *Borg, G., Fröier, K. & Gustafsson, Å. Pallas barley, a variety produced by ionizing radiation: its significance for plant breeding and evolution.* (*pp. 341–49*).

A short review of the genetics and characteristics of the *erectoides* mutants of barley is followed by detailed information on the origin of Pallas (*erectoides* 32, locus *k*), which is an X-ray induced mutant of Bonus, and the productivity, reaction to N fertilizer, lodging resistance and other properties of this new variety, as observed in extensive trials in Sweden [cf. XXIX, 3526]. The value of the induction of mutations in breeding is discussed with reference to useful mutants induced in crops in Sweden and other countries, as well as to the indirect value of induced mutants as parents and the parallelism between spontaneous and artificial mutation from the practical point of view. In the case of barley, other types of mutants, besides the *erectoides* series, may eventually be induced and selected in a fully controlled manner. This will probably be achieved in the case of early mutants of many existing commercial varieties. An early mutant of Bonus is now being tested on a large scale in Sweden and Denmark. The evolutionary significance of a single-gene mutant such as Pallas is briefly discussed.

2383 *Alikhanyan* [*Alihanjan*], *S. I.* et al. *Radiation genetics and the selection of microorganisms.* (*pp. 350–70*).

With reference to published and unpublished work, a comprehensive survey is given of research carried out in the USSR since 1948 to study the induction and behaviour of variants in *Actinomyces* (*Streptomyces*) and *Penicillium* with respect to antibiotic production and vitamin B_{12}. The agents used were X, γ and ultraviolet rays and ethyleneimine, some treatments consisting of a combination of two agents. The following general conclusions have been reached concerning variation in antibiotic production. (1) Plus and minus variation is similar to morphological variation as regards dose-response curves. (2) With each of the four agents, the frequency of variants reaches a maximum at a certain dose and with further increase in dose falls almost to the control rate. (3) Strains differ in respect of critical dosage. (4) Dose-response curves showing rate of occurrence of plus and minus variants are strongly displaced. The critical dose for minus variants lies within the region of large doses, in the area of the sharp drop in survival level, whereas the critical dose for the plus variants is strongly displaced towards the region of small doses. (5) Unselected strains and high-yielding strains which are the product of earlier radio-selection differ considerably in frequency of plus and minus variants induced by the same agent. From an analysis of the antibiotic production of morphologically changed and unchanged colonies it has been tentatively concluded that (1) all zero-activity variants fall into the group of morphologically changed colonies, (2) most of the variants with reduced activity also fall into this category, and (3) most of the plus variants show little or no morphological divergence from typical colonies.

Investigations of variation in antibiotic production in relation to intracellular structures, cytochemistry and changes in the life cycle are given [cf. XXIX, 87]. Examples are described of the development of strains improved in antibiotic synthesis as the result of alternative mutant characters such as lack of pigmentation, reduced synthesis of mannocidostreptomycin, or toleration of P in the medium and thus absence of intense sporulation. Reasons are suggested to account for the observation that the more active the strain and the greater number of generations treated with a mutagenic agent, the more slowly its activity is modified under the influence of the same agent.

2384 *Curtis, H. J. Co-operative studies on radiation-induced mutations in plants.* (*pp. 371–73*).

Over 150 laboratories in the USA and Canada, as well as institutions in 14 other countries, are now participating in the work of screening material irradiated at the Brookhaven National Laboratory, Upton, NY, for desirable mutations. Technical experience gained at Brookhaven in applying different types of radiation to (1) seed of annual crops, (2) trees and shrubs and (3) pollen is summarized. The advantage of neutron treatment of seeds over X irradiation is emphasized. With neutrons, radiosensitivity is completely independent of the moisture and oxygen contents of the seeds and no delayed damage occurs. Plants from seeds exposed to neutrons all exhibit the same degree of injury and thus the optimum dose can be delivered to all the seeds in a group. As many as four times more mutations may be produced by neutron bombardment than by irradiation. Attempts to induce somatic mutations in woody plants have given somewhat disappointing results. The method of pollen irradiation is even less well worked out, dose determination presenting even more difficulties than in the case of seeds.

2385 Bowers, J. L.
The plant irradiation program in Arkansas.
Arkans. Fm. Res. 1959 : **8** : No. 6 : p. 2.
A glabrous, ♂-sterile water melon, ♂-sterile cucumbers without tendrils and lespedeza variants with changes in flower colour and leaf shape possibly of use in varietal identification are among the mutants induced.

2386 Fujii, T. & Matsumura, S.
Radiosensitivity in plants III. Experiments with several polyploid plants.
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 245–52.
In further investigations [cf. XXIX, 3502] the authors determined the effects of exposing the following to acute radiation: (1) autotetraploid *Beta vulgaris, Raphanus sativus, Astragalus sinicus, Capsicum annuum* and *Citrullus vulgaris* and (2) diploid and allotetraploid species of *Oryza, Aegilops* and *Nicotiana,* the amphidiploid *N. tabacum* x *N. debneyi* and 2*x*, 4*x* and 6*x Triticum* spp. Radiosensitivity was evaluated by means of data on germination and survival rates. Autotetraploids were more tolerant of irradiation than diploids but the relationship between radiosensitivity and chromosome number in (2) was not consistent. It is suggested that, in the case of allopolyploids, the chromosomal irregularities or mutations induced in a given genome may not always be balanced by the normal action of the other genomes, whereas such a balance is more likely to be maintained in autopolyploids. Variations in the size of the chromosomes of different genomes may also affect radiosensitivity in allopolyploids. Tolerance may also be influenced by genotypical disparities within a single species.

2387 Tung, T.-C.
A decade of biology in China.
Sci. sin. 1959 : **8** : 1419–44.
The section on genetics gives an account of the application of vegetative hybridization and other Lysenko-Mičurinist methods.

2388 Eliasson, S.
Swedish varieties and strains, their characteristics and cultivation districts.
Småskrift. K. Lantbrukshögskol. Stat. Lantbruksförs. Stat. Jordbruksförs. 1959: No. 109 : 15–40.
This is a new edition of an earlier list [XXV, 119].

2389 L., G. N.
Nya originalsorter. **(New original varieties).**
Försök o. Forskn. 1959 : **16** : p. 59.
The wheat Starke [XXIX, 2467], the vetch Luna [2785] and the spring turnip rape Bele have received official recognition as original varieties. Bele resembles Arlo in all essentials but yields 7% more seed.

2390 Friedberg, C.
Contribution à l'étude ethnobotanique des tombes précolombiennes de Lauri (Pérou). [**Contribution to the ethnobotanical study of the pre-Columbian tombs of Lauri (Peru)**].
J. Agric. trop. Bot. appl. 1958 : **5** : 397–428; 1959 : **6** : 405–35.
Descriptions are given of the plants and parts of plants recovered from the tombs at Lauri. Their relative importance in the life of the people as sources of food, medicine and fibre is assessed as well as, in some cases, their magico-religious significance. Their decorative representation on pottery is discussed and current views on the origin of *Phaseolus lunatus, Arachis hypogaea,* maize and cotton are reviewed.

2391 Choudhri, R. S.
Our concept regarding the possible significance of photo-period and hormones in sex-expression and sex-reversal in plants.
Indian J. Hort. 1957 : **14** : 179–84.
Based on studies of cucumber and maize, the view is expressed that sex expression may be modified by two hormones designated Y and Z, the balance between which is determined by environmental conditions. Sex reversal could then result from a change in equilibrium resulting from changes in the photoperiod.

2392 Strebeyko, P.
Problem wody w fizjologii i hodowli roślin. **(The problem of water in physiology and plant breeding).**
Hodowla Roślin Aklimatyz. Nasiennictwo 1959 : **3** : 415–25.
In studies of 18 sugar beet varieties, clear differences of 1–2% in the water content of the leaves were detected between varieties, while in 21 winter wheats the differences were not significant. The sugar beets also showed a correlation between water content on the one hand and yields of roots, leaves and sugar per ha. on the other. It is suggested that water content influences yield and that it may be worth while to breed for increased water content.

2393 Unger, K.
Die Anwendung radioaktiver Strahlungsquellen zur berührungslosen Massenbestimmung von Pflanzenbeständen und Einzelpflanzen am natürlichen Standort.
(The application of radioactive sources of radiation for determining without contact the masses of plant stands and single plants in the natural habitat).
Züchter 1959 : **29** : 289–93.

Technical details are given of this procedure in use at Quedlinburg. Since the amount of radiation absorbed by the plants depends on the mass of the irradiated material, this quantity may be used as a measure of plant mass. This method is particularly useful for determining changes in size and weight during development.

2394 Schuster, W.
Untersuchungen über die Probeentnahme bei Feldversuchen mit sperrigen Futterpflanzen für Untersuchungen im Labor.
(Investigations on sampling in field trials for laboratory tests with bulky fodder plants).
Landw. Forsch. 1959 : **12** : 260–70.

Experiments were carried out with maize, sunflower and sugar beet tops with the aim of finding an accurate and labour-saving sampling technique for analysis of the composition of forage. It was found that it is unnecessary to test a sample of each replicate of a treatment separately; a mixed sample is adequate provided that enough plants are tested. It is recommended that from each replicate 20–30 neighbouring plants be taken immediately before the harvest. The proportions of leaf, stem and other parts may then be determined separately for each replicate. All the samples from each treatment should then be combined, cut up into pieces of 1 cm. length and mixed thoroughly. From each treatment sample, two lots weighing 1 kg. or four lots weighing 500 g. are taken for drying and analysis. It is important to carry out the sampling and drying as quickly as possible.

2395 Whyte, R. O.
International approach to plant exploration and introduction.
Euphytica, Wageningen 1959 : **8** : 196–208.

The value of plant collection as a means of broadening the genetical basis of crop plants, of studying the origin of cultivated species and of investigating the formation of and relation between biotypes of crop plants and pathogens is discussed and the urgency of the need to establish collections before the centres of variation are eliminated by cultivation is stressed. Current plant introduction work on herbage and fodder plants, pulses, cereals, potato, coffee, cacao and rubber in various countries is summarized. It is suggested that it would be desirable to establish plant exploration centres within centres of origin, to facilitate the collection, maintenance and study of the plant material.

Sokolov, S. Ja.
(Plant introduction and construction of green belts).
Trud. bot. Inst. Komarov (Trans. Komarov bot. Inst.) : Ser. VI : 1959 : No. 7 : Pp. 507. [Russian].

The seventh issue [cf. XXIX, 3590] contains 125 separate articles, which constitute the papers presented to a conference devoted to experiments on the introduction into cultivation of wild species of plant of possible value for Soviet agriculture, horticulture and forestry. The papers are grouped into sections, dealing respectively with: general problems; essential oil, spice, oil and food plants; forage and melliferous plants; medicinal and vitaminiferous plants; industrial plants; and ornamentals.
The following items contain matter of more strictly genetic interest.

2396 *Žukovskij, P. M.* (*The important mission of wild plant species in their hybridization with cultivated plants*). (*pp. 35–39*).

The origin of *Prunus domestica* from crosses of *P. divaricata* x *P. spinosa* is taken as the first example. Others are the origin of *P. ferganica* from *P. ulmifolia* x *P. divaricata*, *Fragaria ananassa* from *F. chiloensis* x *F. virginiana*, *Nicotiana tabacum* from *N. tomentosiformis* x *N. sylvestris* and *Gossypium barbadense* from two species whose identity has not yet been established. Some valuable properties found in several wild cotton species are mentioned, and useful hybrids that have been obtained by crossing with wild species of *Solanum* are enumerated. Rust resistance has been introduced into Russian sunflowers by crossing with *Helianthus lenticularis*, and other species are thought to offer useful sources of breeding material. Other promising species for use in plant breeding are thought to be *Beta macrorhiza*, *Secale segetale*, *S. kuprianovii*, *S. montanum* and many species of *Citrus* and allied genera.
Examples of wild species that have been employed with success in plant improvement

include *Agropyron glaucum, Saccharum spontaneum, Castanea crenata, Cinchona succirubra* and the many wild fruit trees used by I. V. Mičurin.

2397 *Kupcov, A. I.* (*Pecularities of artificial selection in the introduction of plants*). (*pp. 48–52*).

Cases are cited where the plants found in a particular area have proved to be the sole source of certain desirable features, such as the Far-Eastern forms of *Sesamum indicum* resistant to *Fusarium*, the winter-hardy winter wheats of the Volga region, the high-quality forms of *Prunus divaricata* in the Caucasus and late and early flowering forms of *Padus racemosus* in Narym. Sometimes when the introduced forms are grown in new surroundings only some of the progeny survive, in which case selection for adaptation occurs; in this way the winter-hardy Ukrainian lucerne was created. In other cases artificial selection is necessary; Soviet varieties of *Parthenium argentatum* yielding 0·7–1·0* of rubber per ha. have been produced by this method and further selection has led to improvement in the proportion of rubber to resins, which is 0·5 in the variety Pioner Karabaha [Karabah Pioneer], 1·0 in Uzkolistnyj [Narrow-leaved] and 1·2 in the best selections. Tetraploid forms with $2n = 36$ have proved better adapted to cultivation than the diploids.

2398 *Lutkov, A. N.* [*New strains of peppermint* (Mentha piperita) *and the prospects of extending its cultivation to new regions*]. (*pp. 107–10*).

By colchicine treatment of a 72-chromosome individual a fertile allopolyploid with $2n = 144$ was obtained. Selection of the seedlings led to the isolation of several triploid lines which yield 20–40% more essential oil than the peppermint commonly grown in the Soviet Union. They produce a larger number of rhizomes. One of the triploids has been issued as a cultivar under the name Prilukskij 6.

2399 *Stepanova, E. M.* (*The vitamin content of fruits of different varieties of black currant, wild roses, rowan and sea buckthorn and recommendations for their cultivation*). (*pp. 353–56*).

Information is given concerning the cultivars with the highest contents of vitamins C and P in *Ribes nigrum*. The hybrid 23–74 from Laxton x Lija Plodorodnaja [Productive Lija] contains 380 mg. % of vitamin C, which is 49% higher than the former and 60% higher than the latter parent. Hybrid 9–32 from Sentjabrskij [September] x Laxton contains 323 mg. % of vitamin C and several other hybrids from Laxton contain over 300 mg. %. Some varieties showed more variation than others in vitamin C content and improvements have been effected by selection.

The highest contents of vitamin C and P in *Rosa* spp. were found in *R. cinnamomea*, with up to 2500 mg. %, and *R. rugosa* with 1500–1600 mg. %, *Sorbus aucuparia* 'Nevežinskaja Kubovaja' contains 114 mg. % of vitamin C, 2335 mg. % of vitamin P and 10·4 mg. % of carotene, while *S. melanocarpa* has up to 3917 mg. % of vitamin P and *S. domestica* up to 5520 mg. %. In *Hippophae rhamnoides*, values of 200–400 mg. % of vitamin C and 700–2000 mg. % of P have been found.

2400 Tsunoda, S.
A developmental analysis of yielding ability in varieties of field crops. II. The assimilation-system of plants as affected by the form, direction and arrangement of single leaves.
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 237–44.

A report is given of investigations on varietal response in the sweet potato and soya bean to light and heavy manuring in terms of leaf area : leaf weight ratio, size and shape of leaf surface, inclination of the leaf surface and arrangement of the leaves. Theoretical assimilation systems incorporating the leaf, plant and plant population are formulated in relation to heavy and light manuring.

(Proceedings of the Scientific Conference on Plant Protection, Vilnius, 27-31 March 1958).
Akad. Nauk. Lit. SSR, Inst. Biol. 1959 : Pp. 431. [Russian].

The following papers of interest to plant breeders were presented at the conference.

2401 *Fedotova, T. I.* (*The present position of the problem of the immunity of plants to disease in the USSR and further ways of developing it*). (*pp. 15–24*).

A number of instances are cited in which a study of the Soviet world collections of crop plants has revealed a concentration of forms resistant to a given disease or pest in some particular geographical area. Use has been made of these resistant forms in breeding, following the principles of Mičurin concerning the importance of the correct environmental conditions for growing

*Units not stated.

the hybrid seedlings. Various resistant plants that have been produced by vegetative hybridization are referred to; they include a sunflower resistant to *Orobanche*, tobaccos resistant to virus and wheats resistant to smut. By the use of resistant varieties as parents in crossing, Soviet breeders have produced potato varieties resistant to wart. A greater amount of resistance has been obtained in wheat seedlings when the rust-resistant variety has been employed as the seed parent rather than the pollen parent, and complex hybrids have displayed more resistance than homozygous varieties. New races of brown rust have arisen in parts of the Soviet Union where its intermediate host is absent; their origin is ascribed to "physiological, adaptive variation"; this process is also favoured by the use of varieties all based on the same set of closely related parents and can be largely prevented by growing two or more resistant varieties of widely different genetic and biological constitution. The aggressivity of a parasite such as *Phytophthora* can also be reduced by certain treatments of the host plant, such as high doses of K. Conditions of seed storage also affect the resistance of the resulting crop.

2402 *Dorožkin, N. A.* (*The present position of research on potato blight*). (*pp. 239–49*).

Collections of *Phytophthora infestans* from 40 different places in White Russia have shown marked differences in their properties. The most virulent races attack up to 75·6% of all varieties and seedlings tested and attention is being turned towards chemical and other methods of control.

2403 *Karaseva, E. F.* (*The question of the biology of the pathogen of potato wart disease*). (*pp. 255–59*).

Some 50 wart-resistant varieties are available in the Soviet Union but few of them are widely grown in Lithuania. Material of *Synchytrium endobioticum* collected in different localities of the Soviet Union showed differences in respect of the varieties attacked, the most aggressive being the collections from Černovicy, which attacked all the varieties tested except Epicure. Experiments designed to produce a serological method of determining the susceptibility of potato varieties to a given race of the parasite are described.

2404 *Efremenko, T. S.* (*Combined results of tests of wart resistance in potato varieties and seedlings bred by the breeding institutions of the Baltic republics*). (*pp. 261–66*).

In 1950–56, 4450 potato varieties, 858 hybrids and 168 clones from breeding stations in Latvia, Lithuania and Estonia were tested. Of the seedlings from interpollination, 71% were wart resistant, whereas in those from vegetative hybridization only 18% and those from clonal selection 38% were resistant. Progenies from two resistant parents contained up to 78% of resistant seedlings, the highest proportion being obtained when the resistant variety was the seed parent. The varieties that have given the highest proportion of resistant seedlings and the best parental combinations are indicated. Katahdin and Vale are both mentioned as parents to be avoided. The best combination in vegetative hybridization was Ballydoon/Vale/Ballydoon, which gave 100% resistant hybrids. Clonal selections from resistant varieties were all resistant, those from susceptible varieties all susceptible.

2405 *Vinickas, Z., Strukčinskas, M. & Žemajtene, P.* (*Some questions concerning crown-rust resistance in oats*). (*pp. 267–72*).

Figures presented show that the local varieties Girunes and Stipruolec give higher yields of grain in Lithuania than the oat Sovetskij when the severity of crown rust is moderate or less but not in years of severe attack. There is evidence for the existence of several biological races of *Puccinia coronifera* in Lithuania and some indication that the resistance of the variety Sovetskij has diminished in the last four years.

Resistance was increased by high doses of potash and phosphatic manures, and several varieties possessed of increased resistance have been produced by selection from local oats and from crosses with resistant parents.

2406 *Strukčinskas, M.* (*Take-all in winter wheat under the conditions of the Lithuanian SSSR*). (*pp. 279–84*).

The disease described is caused by a mixed infection in which the main organisms are *Ophiobolus graminis* and *Fusarium* spp. No variety has proved truly resistant but those less prone to attack than others include *Triticum* x *Agropyron* hybrid 599, Svalöf 987 and Heine 4.

2407 *Škipsna, Ja. È.* (*Investigations on the causes of winter loss in red clover and some other herbage plants under the conditions of the western zone of the Latvian SSR*). (*pp. 291–305*).

The survey includes data on the reaction of varieties of red clover to *Sclerotinia trifoliorum* and other fungous pathogens. The greatest resistance to clover rot was shown by Stende

Late 11 in the late group and Stende Early 51–j in the early group. These varieties also gave the highest hay yields.

Resistentie in de landbouw. Voordrachten gehouden in de A-cursus op 12, 13 en 14 januari 1959 te Wageningen. **(Resistance in agriculture. Lectures presented at the A course on 12, 13 and 14 January, 1959, at Wageningen).** 1959 : Pp. 96.

2408 *Oort, A. J. P. Vormen van resistentie.* (*Forms of resistance*). (*pp. 5–9*).

The following types of resistance to plant pathogens are briefly described: preinfection resistance; resistance to penetration and to spread of the pathogen within the host, both of which may involve either passive or active resistance; seedling resistance; adult plant resistance; resistance due to escape; tolerance; hypersensitity; and field resistance. The effect of temperature upon resistance is also mentioned.

2409 *Kole, A. P. Anatomische verschijnselen van de resistentie.* (*Anatomical symptoms of resistance*). (*pp. 10–15*).

The different methods of entry into and propagation within the host shown by different pathogens are surveyed. The types of mechanical resistance afforded by the cell materials of different plant tissues are indicated and a number of kinds of chemical resistance reaction discussed.

2410 *van Andel, O. M. Fysiologische-chemische achtergrond van de resistentie van planten tegen schimmels en bacteriën.* (*Physiochemical background of the resistance of plants to fungi and bacteria*). (*pp. 16–26*).

In this review the following causes of resistance are considered in turn: the presence of host substances toxic to the parasite; the failure of the host to provide substances necessary for the growth of the parasite; and other causes such as turgor or low permeability of the cell. Examples of changes in resistance effected by treatment with appropriate chemicals are given.

2411 *Zadoks, J. C. Rasvorming bij parasitaire schimmels.* (*Physiological specialization in parasitic fungi*). (*pp. 27–35*).

This is a Dutch version of an article already abstracted [cf. 1358].

2412 *Wit, F. Resistentie tegen abiotische factoren.* (*Resistance to abiotic factors*). (*pp. 36–46*).

Hypotheses concerning the nature of resistance to damage by low temperatures, drought and high temperatures are reviewed and experimental methods suitable for determining the different kinds of resistance are noted.

2413 *Kerling, L. C. P. De invloed van de uitwendige omstandigheden op de resistentie.* (*The influence of external conditions upon resistance*). (*pp. 47–53*).

Examples of the effects upon resistance of temperature, moisture, light and nutrients and of the age of the host plant are presented and work on some of the mechanisms involved is surveyed.

2414 *Winkler, K. C. Resistentie van bacterien tegen antibiotica.* (*Resistance of bacteria to antibiotics*). (*pp. 59–66*).

The above subject is discussed with reference to the development, genetics and physiology of resistance.

2415 *Dorst, J. C. Bronnen voor resistentie.* (*Sources of resistance*). (*pp. 74–79*).

Sources of resistance to pathogens and environmental factors are found among commercial varieties and land races and at the gene centres of the crops in question; examples of resistant material from each of these three categories are given, potato and wheat being the crop plants chiefly mentioned.

2416 *Toxopeus, H. J. Problemen bij de veredeling op resistentie.* (*Problems in breeding for resistance*). (*pp. 80–87*).

Drawing his examples mainly from work on breeding potato for resistance to blight and eelworm, the author outlines some of the problems in transferring resistance genes from wild material to susceptible cultivated varieties. The difficulties include: close association of the resistance genes with undesirable characters, due to either linkage or pleiotropy; cross incompatibility; and the need for combining several types of resistance in one variety.

2417 *s'Jacob, J. C. De bepaling van de resistentie.* (*The determination of resistance*). (*pp. 88–96*).

The following requirements of adequate testing procedures are described.

A suitable method must (1) give a degree of infection which does not allow susceptible plants to escape; (2) be applicable to large numbers of plants; (3) be simple and inexpensive; (4) fit in with the selection scheme for the crop; (5) be suitable for use at an early stage in plant development. The pathogenic culture must be pure, highly virulent and of

known composition with respect to physiological races. Infection may be carried out artificially in the greenhouse or field or may be allowed to develop naturally in the field.

2418 Toxopeus, H. J.
Problems involved in breeding for resistance.
Euphytica, Wageningen 1959 : **8** : 223–31.
This article has already been summarized from another source [2416].

2419 Rusakov, L. F. & Zvjaginceva, E. I.
(The breeding of crop plants for immunity, a reserve for increasing yield).
Selekcija i Semenovodstvo (Breeding and Seed-growing) 1959 : No. 2 : 15–18. [Russian].
Resistance breeding in the USSR is discussed and a number of wheat, oat, maize, potato, cotton, flax, sugar-beet and tobacco varieties resistant to the principal diseases and with other desirable characteristics are listed. Most of these varieties have been in cultivation for some time. Hybridization is regarded as the most effective method for breeding resistant cultivars.

2420 Rodigin, M. N.
(Studies on immunity of plants in the Chinese People's Republic).
Selekcija i Semenovodstvo (Breeding and Seed-growing) 1959 : No. 2 : 61–63. [Russian].
This survey of resistance breeding in China mentions some of the results obtained with the crops mentioned below.
Wheat. A few recent varieties resistant to flag smut or rusts are listed. Some of the rust-resistant varieties are characterized by combined resistance to *Puccinia glumarum, P. triticina* and *P. graminis*. Studies of the Chinese strains of *Tilletia* and *Urocystis* are in progress and keys to identification of the principal strains have been prepared. Mention is made of strain 12 of *Urocystis* attacking hard wheat which has hitherto been regarded as immune from this fungus.
Barley. Varietal differences in resistance to covered smut are being studied, a high degree of resistance having been observed in the naked barley variety Manchuria, an introduction from the USA. A key to the identification of 9 strains of *Ustilago hordei*, which have been isolated in China, has been completed.
Setaria. A few varieties resistant to smut are listed, one of these being also resistant to *Sclerospora*.
Rice. Breeding for resistance to *Piricularia* is reported and 16 new resistant varieties for the principal rice-growing areas are named.
Cotton. Several varieties resistant to *Verticillium* wilt have been obtained by single-plant selection. In particular mention is made of D15, S28, Dlinnoe Volokno 2 [Long Fibre 2] and Železnaja Obez'jana.

2421 Puia, I.
Cercetări asupra relației dintre vîscozitatea protoplasmei și rezistenta plantelor la ger. **(Investigations on the relation between protoplasmic viscosity and the resistance of plants to frost).**
Lucrăr. ști. Inst. agron. Petru Groza Cluj 1959 : **15** : 65–85.
This study is primarily concerned with differences in winter hardiness between plants in general. However intervarietal differences in winter hardiness in wheat and barley are mentioned briefly. Resistance to low temperature appears to be positively associated with the capacity of the protoplasm to bind water at low temperatures and negatively with degree of protoplasmic viscosity at such temperatures.

CEREALS

2422 Müller, K.-H.
Ergebnisse mehrjähriger Sommergetreidesorten-versuche. **(Results of several years' spring-cereal variety trials).**
Z. landw. Vers.-UntersuchWes. 1959 : **5** : 50–69.
The results of trials of many varieties of wheat, barley and oats in Eastern Germany during 1951–57 are discussed. Of the spring wheats, Peko was found to be the least demanding and gave on the whole the best results; Capega was more demanding but under favourable conditions it outyielded Peko. Elsa was the least demanding of the spring barleys and Freya was found to be very productive but is more particular as regards soil, climate, preceding crop and time of sowing. Saale, another undemanding variety, gave lower yields than Elsa and Freya; it has a short growing period and gives good yields in high locations. Fläminsgold, Goldhafer 11 [Golden oat 11] and Universal are the most important oats in the German Democratic Republic; Universal gave a good performance in all districts. Flämingstreue and Universal are less demanding than the others.

2423 Strona, I. G.
(Conferences on breeding and seed production in the Ukraine).
Selekcija i Semenovodstvo (Breeding and Seed-growing) 1959 : No. 2 : 79–80. [Russian].
Recent conferences at Har'kov, Dnepropetrovsk and Poltava are mentioned and the titles of papers read at Har'kov dealing with the breeding of buckwheat, rye, oats and barley are given.

2424 Strand, E.
Valg av kornsorter i 1960. **(Choice of cereal varieties in 1960).**
Samvirke 1960 : **55** : 161–63.
On the basis of varietal trials, results of which are presented, recommendations of barley, oat and spring wheat varieties for south-eastern Norway are made.

2425 Holme Hansen, H. H.
Lokale forsøg og andre planteavlsarbejder. **(Local trials and other crop production work).**
Planteavl. Loll.-Falster. 1959 : 19–50.
The work described includes varietal trials of wheat, oats and barley held at various localities in Lolland and Falster, Denmark.

Tien-jarenplan voor graanonderzoek. Verslag over het vijfde jaar 1958. **(Ten-year plan for cereal research. Report for the fifth year, 1958).**
Nederlands Graan-Centrum, Wageningen 1958 : Pp. 128.

2426 *Dantuma, G. & Mesdag, J. Verslag over kruisingsprogramma en klimaatresistentieonderzoek. (Report on the crossing programme and investigations on climate resistance). (pp. 15–21).*
Wheat. American and Russian winter varieties with good winter hardiness and vigorous spring development have been crossed with material resistant to yellow rust and mildew. Among spring wheats, various crosses have been made with the aim of increasing productivity, disease resistance and baking quality in breeding material and of combining the rust and mildew resistance of late-developing lines with the early growth and maturity of some French and Italian varieties.
Oats. Crosses with *Avena sterilis* have been made with a view to developing material resistant to *Heterodera schachtii*. A number of winter varieties from the USA, south-east Europe, France and England appear to have a certain cold requirement and have been used in crosses to increase the winter hardiness of material for the Netherlands.
Barley. Numerous winter-barley crosses are being tested for adaptation to sandy soils. In spring barley, breeding for disease resistance is important and a few selections with combined resistance have been obtained in which the linkage between mildew resistance and susceptibility to yellow rust appears to be broken.

2427 *Belderok, B., Meppelink, E. K. & de Ruiter, D. Methodiek bakwaarde-onderzoek van kleine monsters tarwe. (Methodology of research on the baking quality of small samples of wheat). (p. 23).*
Investigations on the use of microtests in evaluating baking quality continued [cf. XXIX, 2308].

2428 *Meppelink, E. K. Registratie van het bakwaardeniveau van de inlandse tarweoogst 1958. (Record of the level of baking quality of the Netherlands wheat crop in 1958). (pp. 25–37).*
Details of regional and varietal differences in grain and flour quality and bread-making properties are given for eleven varieties.

2429 *Belderok, B. Verslag van het in 1958 verrichte onderzoek aangaande kiemrust en schot. (Report of investigations on dormancy and sprouting carried out in 1958). (pp. 38–51).*
Germination tests have shown that at harvest time wheat grains do not show true dormancy but only a period during which germination is very slow. In tests of 19 varieties, those which sprout in the ear differed from those resistant to sprouting in (*a*) their greater germinating power, i.e. percentage of grains germinating in seven days under optimum conditions, (*b*) their shorter period of slow germination and (*c*) their lower water requirement for germination. Tests of entire ears at 18° C. and 100% humidity and of grain samples under optimum germination conditions gave a similar varietal order of resistance to sprouting. When grain samples were germinated with suboptimum amounts of water, the varieties fell into two groups, those able to germinate and those unable. The former group corresponded to varieties which showed high α-amylase activity in trial plots exhibiting high or moderate degrees of sprouting, and the latter to varieties showing high activity only in plots in which a high degree of sprouting occurs. The relation between germination and contents of polyphenols and catechol oxidase is under investigation.

2430 *van Wieringen, G. Vergelijking van het voorkomen van de schadelijke faktor in rogge bij 10 inteeltstammen.* (*Comparison of the occurrence of the noxious factor of rye in ten inbred lines*). (*p. 55*)

When used to feed rats, three of the lines had a markedly greater inhibitory effect on growth than the others.

2431 *van Dobben, W. H. Verslag van proefnemingen op het gebied van het fundamentele graanonderzoek.* (*Report on experiments in the field of fundamental cereal research*). (*pp. 59–79*).

Data on the photoperiodic responses of the Swedish wheat Blanka, the German variety Peko and the North African variety Florence x Aurore are presented. In the order given, the three wheats showed a decreasing long-day requirement. With basic day lengths of 8, 15 and 15 hr. supplemented by weak artificial lighting to a total of 18 hr., the last variety showed no response and the first again showed greater requirement for long basic photoperiod than the second.

2432 *Broekhuizen, S. Het observatieproefveld voor de veenkoloniën in 1958.* (*The observation trial field for the peaty districts in 1958*). (*pp. 81–83*).

Data on a yield trial of 16 wheat varieties are included.

2433 *Becker, G. J. F. Het onderzoek van "kafjesbruin" van de tarwe in 1958.* (*Investigations on glume blotch of wheat in 1958*). (*pp. 99–107*).

Injecting the heading plants with a spore suspension of *Leptosphaeria nodorum* proved a more satisfactory method of artificial infection than wiping or spraying the ears with the suspension. Degree of susceptibility was estimated from the decrease in 1000-grain weight and varied according to variety. Sowing date and fertilizer treatment also influenced degree of infection.

2434 *Zadoks, J. C. Het gele-roestonderzoek in 1958.* (*Investigations on yellow rust in 1958*). (*pp. 109–19*).

The Heine's VII physiological group appeared to be the most widespread in Europe, followed by the Capelle group.

2435 *Kort, J. Onderzoek naar het voorkomen van fysiologische rassen van het havercystenaaltje.* (*Investigations on the occurrence of physiological races of the oat nematode*). (*p. 123*).

Work on the above project has begun.

2436 Hodges, H. F. *et al.*
Small grain varieties for Indiana. Performance, 1955-59 and recommendations for 1960.
Res. Bull. Purdue Univ. 1959 : No. 691 : Pp. 20.

The results of trials of varieties of winter wheat, spring and winter oats, winter rye and winter barley are summarized.

2437 Fadrhons, J.
Příspěvek k metodikám šlechtění obilovin. (**A contribution to the methods of breeding cereals**).
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 361–76.

In this general discussion of breeding methods, details are given of the selection procedures used in Czechoslovakia for rye and for self-pollinated cereals.

2438 Wolski, T.
Niektóre aktualne zagadnienia hodowli roślin zbożowych. (**Some present-day problems in breeding cereals**).
Postępy Nauk Roln. 1959 : **6** : No. 3 : 3–25.

In malting barley quality takes precedence over yield as a breeding objective; the same is true to a lesser extent for spring wheat but for all other cereals yield is the main consideration. Other features in which improvements are sought are freedom from lodging, shedding and sprouting; figures are given showing that the percentage of sprouting in the 1956–57 season varied in winter wheat varieties from 0·4 in Dańkowska Sztywna [Dańków Stiff] to 23·5 in Dańkowska Zachodnia [Western Dańków].

Attention is called to the possible merits of the method of cloning in improving rye [cf. XXVII, 1676] and a description is given of a system of rye improvement adopted by the author, in which polycrosses are made between lines selected at two distinct places, the object being to enhance the genetic heterogeneity, and hence, presumably, adaptability, though certain cereal varieties are mentioned which combine a wide range of adaptation with a high degree of homogeneity; these include the Polish barley Skrzezowicki and the French wheat Capelle. The wheat Dańkowska Graniatka, which appears in the pedigrees of a great number of the best Polish wheats, in combination with Ardito, with a very different range of ecological adaptation, gave rise to one of the most successful Polish wheats, Wysokolitewka Sztywnosłoma [Stiff-strawed Tall Lithuanian]. The variety Dańkowska Graniatka was produced by back

crossing the hybrid Kostromka x Squarehead to Kostromka and the value of modern methods such as back crossing and multiple crossing is discussed; it is pointed out however that, though they are more rapid, they require much larger quantities of material and hence of space and labour. Various versions of the bulk population method are also discussed, including those of Rudorf [cf. XXVII, 318] and of Lupton and Whitehouse [cf. XXVIII, 1461] and reference is made to a number of devices which have been used by plant breeders to speed up the work of testing for such features as winter hardiness, baking quality and lodging resistance.

Figures are given showing that in comparative tests in 1953–57 the improved wheat varieties Wysokolitewka Sztywnosłoma and Dańkowska 40 [Dańków 40] gave respectively 2·85 c. and 1·95 c. of grain per ha. more than the two older varieties from which they were bred, Wysokolitewka Kleszczyńskich and Dańkowska Selekcyjna [Dańków Selected], when grown under the same conditions; the gain from growing these two varieties is estimated at between 200 and 400 million złoty annually.

2439 Petrov, I. A.
(Changing the heritable basis of grain crops by means of injections).
Sbornik: Voprosy Metodiki Selekcii Pšenicy i Kukuruzy (Symposium: Problems of methods for breeding wheat and maize), Har'kov Univ. 1957 : 263–80 : from Ref. Ž. (Ref. J.) 1958 : No. 15 : p. 33 : Abst. 66780. [Russian].

Changes in the heritable basis of such plants as oat and barley are said to have been obtained by injecting into the grains of these plants the endosperms of wheat by means of a syringe. The forms obtained did not transcend the intergeneric barrier and it is thought that similar forms could arise from spontaneous hybridization between forms belonging to the maternal genus.

2440 Strun [Stroun], M.
(Vegetative hybridization of plants).
Agrobiologija (Agrobiology) 1959 : No. 2 : 213–19. [Russian].

[Cf. XXIX, 1112].

2441 Ruckij, I. A.
(Comparative analysis of the methods of vegetative hybridization of cereals).
Bjull. Obšč. Estestoispyt. voronež. Univ. (Bull. Soc. Nat. Voronež Univ.) 1956 : **10** : 11–25 : from Ref. Ž. (Ref. J.) 1958 : No. 15 : Abst. 66781 : p. 33. [Russian].

A method of embryo transplantation was the better of two techniques of vegetative hybridization of cereals which were studied.

2442 Grinwald, C.
Transformarea cerealelor de toamnă în cereale de primăvară şi a cerealelor de primăvara în cereale de toamnă. (**The transformation of winter cereals into spring cereals and of spring cereals into winter cereals**).
An. Romîno-Soviet. : Ser. Agric.-Zooteh. 1959 : **13** : No. 2 : 71–82.

Work along the above lines conducted by Lysenko and his school in the USSR is reviewed. In Rumania, Boteanu is said to have applied these methods to produce the oat variety ICAR1 from the spring oat Tîrgu Frumos 9.

2443 **Cereal varieties for 1960.**
Agriculture, Lond. 1960 : **66** : 516–17.

Varieties of winter wheats.
Fmrs'. Leafl. nat. Inst. agric. Bot. 1960 : No. 8 : unpaginated.

Varieties of spring wheats.
Ibid 1960 : No. 9 : unpaginated.

Varieties of barleys.
Ibid 1960 : No. 10 : unpaginated.

Varieties of oats.
Ibid 1960 : No. 13 : unpaginated.

Information is given on varieties recommended on the basis of the results of trials carried out by the National Institute of Agricultural Botany, United Kingdom. Of the oats, mention may be made of a new recommendation, Manod, a spring variety bred by the Welsh Plant Breeding Station from Tama x 01751/10 and possessing marked resistance to mildew, crown rust and oat stem eelworm.

2444 Kul'bij, A. I.
(Pollen viability of some cereal crops).
Selekcija i Semenovodstvo (Breeding and Seed-growing) 1959 : No. 2 : 23–24. [Russian].

The storage periods for wheat, rye, maize and barley pollen were lengthened at Odessa by placing the pollen in a desiccator above $CaCl_2$ at a temperature of 2–4° C. or by using a field thermostat specially constructed for keeping wheat pollen dry and cool. Barley pollen remained viable longer when entire anthers were stored. It was found that the pollen of all hard and soft wheats remained viable after being stored for 5 hr. and that the pollen of *Triticum persicum* and *T. timopheevi* could be stored for

24 hr. The storage period for rye pollen extended to 3 days while some pollen was still viable on the eighth day. Maize pollen could be stored for 6 days without a noticeable reduction of viability and some pollen was active even after 16 days. Barley pollen remained viable for 2–3 days.

2445 KIKUCHI, M.
(Studies on the transplantation of young embryos in cereals. V. On embryonic growth in transplanted embryos).
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 140–44. [Japanese].
Experiments in which the embryos of 8 wheat and 5 barley varieties were transplanted to endosperms of 10 wheat species, barley, rye or rye-wheat are reported. It was found that embryonic growth in the transplanted embryos could approach that of intact embryos.

2446 SALČEVA, G.
(A study on the frost resistance of some wheat, rye and winter barley varieties).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.) Sofija 1958 : **5** : 259–77. [Bulgarian].
Twenty wheats, five ryes and eleven winter barleys were classified according to frost resistance after being tested in refrigerators.

2447 NOVEROVÁ, I.
O metodách zjišťování rezistence vůči chorobám obilovin. **(Methods for evaluating resistance to cereal diseases).**
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 377–90.
Details are given of the techniques used for testing the Gatersleben collection of barley and wheat varieties for resistance to species of *Erysiphe, Puccinia, Helminthosporium, Ustilago* and *Tilletia.*

2448 **Report of cooperative uniform cereal rust observation nurseries for the year 1958.**
Publ. U.S. Dep. Agric., Agric. Res. Admin., Bur. Pl. Industr., Soils, Agric. Engin. Beltsville, Md. 1959 : No. 40 : Pp. 44. (Mimeographed).
Data are given on the reactions of varieties and selections of (1) wheat to *Puccinia graminis* var. *tritici* and *P. rubigo-vera* var. *tritici*, (2) oats to *P. graminis* var. *avenae* and *P. coronata* var. *avenae* and (3) barley to *P. graminis* var. *tritici* and *P. hordei* in observation nurseries in the USA. The most interesting features of the results are discussed, particularly with reference to physiological races.

2449 KRITZINGER, A.
First climate chamber for small grain expedites breeding of new varieties.
Fmg. in S. Afr. 1960 : **35** : No. 11 : p. 30.
A time-saving climate chamber in which several generations of wheat or barley may be raised in a single year is in use at the Department of Genetics, Stellenbosch-Elsenberg College of Agriculture. Its advantages, particularly in breeding for rust resistance, are described.

2450 ZADOKS, J. C.
Cereal and grass rusts of the Netherlands.
Robigo, Castelar 1959 : No. 8 : 1–3; also in Spanish, 3–6. (Mimeographed).
Notes are presented on the occurrence in the Netherlands of stripe, leaf and stem rusts of wheat and barley, leaf and stem rusts of rye and crown rust of oats and ryegrass; three stripe-rust races attacking the wheats Heine's VII, Alba and Peko respectively and the wheat leaf-rust race 17 are mentioned. A table showing the main spring and winter wheats and barleys, their resistance to stripe and leaf rust and the area under cultivation is included.

2451 SILVA, A. R. DA
Differential varieties used at the "Instituto Agronómico do Sul" for rusts race identifications.
Robigo, Castelar 1959 : No. 7 : p. 6 : also in Portuguese, p. 6 and Spanish, p. 7.
The cereal varieties used in the study of populations of stem and leaf rusts of wheat, stem and leaf rusts of oats and leaf rust of barley in the states of Rio Grande do Sul, Santa Catalina and Paraná, Brazil, are listed.

2452 MASAKI, J.
(Studies on *Tipula aino*, in particular its ecology and prevention).
Kantotosan Nogyo Shikenjo Kenkyu Hokoku/J. Kanto-Tosan agric. Exp. Sta. 1959 : No. 13 : Pp. 202.
A section of this monograph is devoted to varietal differences in susceptibility to the above pathogen in rice, wheat and barley. As regards rice, nonglutinous varieties tend to be less injured than glutinous varieties and early varieties less than late varieties. The most resistant rices were the early nonglutinous

varieties Norin 1 [Ministry of Agriculture and Forestry 1] and Hachikan. The most resistant wheat was Norin 58. Hulled barleys tended to be more resistant than naked varieties, the most resistant form being the hulled variety Kirinchoku 2.

Proceedings of the Fourth British Weed Control Conference organized by the British Weed Control Council and the Pesticides Group of the Society of Chemical Industry held at the Hotel Metropole, Brighton, November 4-6, 1958 : Pp. 271.

2453 *Elliott, C. S. The relative susceptibility of cereal varieties to growth regulator herbicides. Some preliminary investigations with MCPA and 2,4-D (also CMPP and 2,3,6-TBA).* (*pp. 61–66*).

The effect on plant form of heavy doses of MCPA and 2,4-D applied at an early growth stage to different varieties of spring wheat, oats and barley was investigated; CMPP and 2,3,6-TBA were also tested on a limited scale. Wide variation in varietal reaction to MCPA and 2,4-D was found in all three crops, and varietal differences were also indicated in reaction to 2,3,6-TBA and, to a lesser extent, CMPP. From a subsequent investigation it is concluded that the varietal differences cannot be accounted for simply by differences in the stage of development at the time of spraying.

WHEAT

2454 Moldenhawer, K.
Profesor Dr. Kazimierz Miczyński jako wybitny uczony i hodowca roślin. (**Prof. Dr. Kazimierz Miczyński, an outstanding scientist and plant breeder**).
Postępy Nauk Roln. 1958 : **5** : No. 6 : 131–37.

An account is given of the work of this Polish breeder on the occasion of the 90th anniversary of his birth, mention being made of his early experiments on Mendelian inheritance in wheat crosses, published in 1905, of crosses of wheat x rye made by him as early as 1903, and of three well-known wheat varieties produced by him; these are Hanka and Złotka, both from Ostka Mikulicka x Extra Squarehead, and Dublanka [(Ostka Mikulicka x Extra Squarehead) x Wysokolitewska (Tall Lithuanian)].
A list of Miczyński's publications on plant breeding is appended.

2455 Perttula, O.
Syysvehnän lajike-kokeiden tuloksia. (**Results of winter-wheat variety trials**).
Koetoiminta ja Käytäntö 1959 : **16** : p. 23.

A number of varieties have been tested at the trial ground in south-west Finland and were compared for grain yield, strength and height of stalk and for earliness. Vakka [Bushel] gives an outstanding yield, being the only variety to surpass Varma [Sure] but its value is offset by its tendency to sprout in the ear. Length of stalk is greatest in Antti while straw strength is greatest in Odin and Väinö. Vakka is the earliest variety, maturing in 8 days less than Varma.

2456 Bericht over rassenkeuze. Zomertarwe 1960. (**Report on choice of varieties. Spring wheat, 1960**).
Zaadbelangen 1960 : **14** : p. 8.

In trials of seven varieties on different soil types in the Netherlands, the new variety Opal gave good yields on most soils, and MGH50–14, which is still in the early stages of testing, showed promise on clay soils.

2457 Stajkova, E. & Christov, J.
(**Results of a comparative varietal study of Soviet winter wheats in Bulgaria**).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1958 : **5** : 231–46. [Bulgarian].

The 12 Soviet varieties investigated were less productive in Sofia than the standard varieties and they are not recommended for general cultivation. It is however suggested that some of the varieties be used as breeding material; these include Lutescens 17 and Novoukrainka 83 which are resistant to lodging and have good technological characters, Lutescens 329 which is resistant to cold and Vorošilovskaja, a rust-resistant variety.

2458 Velican, V., Cebotaru, V., Ostrogovich, S., Pop, E. & Roman, A.
Rezultate experimentale cu soiuri şi linii noi de grîu de toamnă la Cluj. (**Experimental results with new varieties and lines of winter wheat at Cluj**).
Probl. Agric. Bucureşti 1958 : **10** : No. 7 : 14–24.

Trials of Rumanian varieties and new lines bred at Cluj are reported. Of the varieties, Cenad 117 and Odvoş 241 were best, taking both yield and baking quality into consideration. Of the

lines, Cluj 638 (0156 x Cluj 644), Cluj 918 (Odvoş 241 x Kanred) and Cluj 722 (Barrukan x Oro 8220) combine high yield and resistance to lodging; the last two are also early and of superior baking quality.

2459 Timariu, A.
Comportarea unor linii noi de grîu de toamnă la Staţiunea Experimentală Agricolă Cîmpia-Turzii. (**Behaviour of some new lines of winter wheat of the Cîmpia-Turzii Agricultural Experimental Station**).
Stud. Cercet. Agron., Cluj 1958 : **9** : 85–94.

Nine lines obtained by open pollination of A15 by a mixture of pollen parents at the above station were tested for yield, vegetative period, resistance to frost, rusts and lodging, grain size and chemical composition of the grain. Line 7/54 yields well and is resistant to rusts and lodging; lines 183/54 and 1/54 are early, rust resistant and of superior quality.

2460 Giosan, N.
Comportarea soiurilor de grîu de toamnă autohtone şi din import în condiţiile anului agricol 1957–1958. (**Behaviour of indigenous and imported winter-wheat varieties under the conditions of the agricultural year 1957-58**).
Probl. Agric., Bucureşti 1958 : **11** : No. 1 : 28–41.

Trials spread over six centres in Rumania are reported, the entries comprising Rumanian varieties and introductions from Austria, Bulgaria, France, Germany, Holland, Hungary, Italy, Poland, the USA and the USSR. Some of the Italian and American varieties gave notably high yields and were early and resistant to lodging. The Soviet varieties were especially resistant to frost and drought.

2461 Didus', V. I. & Mel'nikov, N. I.
Promising varieties of strong-floured winter wheat in the woody steppe of the Ukraine).
Selekcija i Semenovodstvo (Breeding and Seed-growing) 1959 : No. 2 : 9–14. [Russian].

This report on breeding and quality testing of bread wheats at Har'kov mentions four recent cultivars with a strength of flour of the order of 320–400 erg. Erythrospermum 88 (Erythrospermum 107 x Lutescens 17) is early, winter hardy, moderately resistant to drought and fairly resistant to lodging, shedding, smut and bunt. Lutescens 172 is an interspecific hybrid between the soft wheat Odessa 3 and *Triticum turgidum* 'Kahetinskaja Vetvistokolosaja' [Kahetian Branched-eared]. It equals Odessa 3 in drought resistance, does not shed or lodge, and is early and moderately frost resistant. Milturum 64 (Saljut [Salute] x Lutescens 266) is resistant to bunt, smut and above average in degree of resistance to brown rust. Its resistance to drought, frost and lodging is fair. All the above varieties outyielded the standard Odessa 3 by at least 4 c. per ha. and are in advanced trials.

2462 Sikka, S. M. & Jain, K. B. L.
A study of the differential response of some varieties of wheat to different environmental and cultural conditions. I. Performance under rain-fed conditions.
Indian J. Agron. 1958 : **3** : 71–81.

A report is given on the performance of 51 varieties of *Triticum aestivum* tested under rain-fed conditions for three years at the Indian Agricultural Research Institute, New Delhi. NP823, NP824 and NP828 showed the best adaptation to such conditions and in addition good adjustment to seasonal fluctuations in rain supply. The adaptability of these varieties may possibly be attributed to their "wider genetic diversity," NP823 and NP824 having been derived from a double cross and NP828 from a complex cross.

Proceedings of the First International Wheat Genetics Symposium held at the University of Manitoba, Winnipeg, Manitoba, Canada August 11 to 15, 1958 : Pp. 268.

The full texts are given of the contributions to the above symposium, of which a preliminary account has already been summarized [cf. XXIX, 2448]. The many points of interest raised in the discussions after the papers are also recorded.

2463 *Briggs, F. N. Backcrossing—its development and present application. (pp. 8–11).*

Some reported cases of application of the back-cross method to wheat and other crops are commented upon. The full back-cross technique should be distinguished from "limited backcross breeding", in which only one to three back crosses are carried out so as to retain some of the variability of the hybrid as regards characters other than the particular one being transferred. The technique as practised by the author and associates at the University of California, Davis, has had the aim of reconstituting

the recurrent parent, except for the required character of the donor.

2464 *Borlaug, N. E. The use of multilineal or composite varieties to control airborne epidemic diseases of self-pollinated crop plants.* (*pp. 12–27*).

The author gives a detailed review of work in Mexico on the development of multilineal varieties by back crossing. When distributed commercially, each composite is to consist of a mechanical mixture of a number of phenotypically similar lines genotypically different with respect to stem-rust resistance. Four multilineal varieties are being developed, the following wheats having been used as recurrent parents: Gabo, with the *Triticum turgidum* type of resistance; Lerma 50 and Kentana 48, with the Kenya 324 type, and Yaqui 50, with the Newthatch type. Many donor parents were chosen for crossing with these four varieties. Information gained during the past three years concerning procedures of breeding and testing at all the various stages of the project is summarized and the results obtained from regional yield tests of experimental composites are assessed. These tests have shown that commercially acceptable multilineal varieties may be produced fairly easily, provided the lines are carefully selected in the "classification nursery"; one line misclassified for stem-rust reaction is sufficient to make a composite valueless. It is easier to produce a commercially acceptable variety if 12–16 lines, rather than 4–8, are used, since disparities in height, time of maturity and ear type tend to be cancelled out with higher numbers of lines. Many of the multilineal varieties outyielded the recurrent parent in the absence of rust. Yield increases have been more frequently attained in varieties derived from first, second or third back-cross material than from more advanced back crosses. Phenotypically, many of the varieties approached the recurrent parent so closely that farmers would have been unable to distinguish them from their ordinary counterparts. Tests of milling and baking quality of the composites and their component lines have not yet been completed. Reasons are given in support of the view that the heterogeneity of the composites will offer an effective means of rust control.

2465 *Ausemus, E. R., Gibler, J. & Peterson, R. F. Discussion of methods and procedures in wheat breeding.* (*pp. 28–30*).

In this unscheduled item, E. R. Ausemus gave a sketch of the organization and methods of breeding in the USA. The pedigree, back-cross and bulk methods, or a combination of all three, are in use. J. Gibler commented upon breeding in Colombia, where resistance to yellow rust is of primary importance and the possibility of developing multilineal varieties is being explored. With reference to Canada, R. F. Peterson briefly assessed the back-cross and multiline techniques. In view of the quality requirements in that country and the time taken in quality evaluation, it is thought that adoption of the latter method is unlikely since it would be even slower than the individual-line method.

2466 *Knott, D. R. The inheritance of stem rust resistance in wheat.* (*pp. 32–38*).

Work on the inheritance of stem-rust resistance in common wheat at the University of Saskatchewan is surveyed. Some results from previously reported investigations on resistance to races 15B and 56 are cited in illustration of the genetical analysis to which 29 varieties have been subjected by means of back and diallel crossing [cf. XXVIII, 1567, 337 and XXVII, 439]. An unexpected feature is the relatively low number of genes discovered, although the varieties chosen for study had as diverse origins as possible. In the first eight wheats studied, seven genes (*Sr*6–*Sr*12) were detected. No new genes have so far been definitely shown to be present in the 21 remaining varieties tested. Possibly more genes will be found when other races are used. The Chinese Spring monosomics developed by Sears have been used in locating genes for resistance. Much of this work has merely corroborated results obtained by other investigators and is therefore not presented in any detail. The positions of all the genes except *Sr*10 are now known. A final step in the project has been the transfer of each gene, singly, to the susceptible variety Marquis by back crossing. Lines derived from five back crosses to Marquis are available for *Sr*6 to *Sr*9. This material is undergoing test for reaction to a large number of races at Winnipeg and in Australia and Kenya. The back-cross lines may also serve as testers in the identification of genes for resistance and are now being used instead of diallel crosses.

2467 *Silva, A. R. da. The integration of wheat breeding and rust identification.* (*pp. 39–48*).

Comments are made on ways in which breeders in various countries of the world have studied pathogen variability with respect to races, subraces and biotypes. The theoretical and practical limitations of various types of differential sets of wheats are indicated, suggestions

being included as to the development and use of sets composed of isogenic lines or chromosome-substitution lines.

2468 *Vilmorin, R. de. Wheat breeding in France—problems and methods.* (*pp. 49–54*).

Winter and spring-wheat breeding in France is discussed from the point of view of the private breeder.

2469 *Thorpe, H. C. Wheat breeding in Kenya.* (*pp. 55–64*).

The author considers the rust problem as a whole in Kenya, the occurrence of stem-rust races, breeding from 1921 up to the present time, and genetical and other aspects of the unsatisfactory quality of Kenya wheats. Recently, the following introductions have proved to be the most useful as parents conferring stem-rust resistance: Mida-McMurachy-Exchange (II–47–26); CI12632 (Illinois x Chinese[3]) x *T. timopheevi*, an introduction from Mexico including RL2265-Redman, Yaqui and Maria Escobar - Supremo 3567 in its pedigree; Reward-H44 x Rhodesian, 35A–54; and Maria Escobar x H44-Marquis, 81A–54. New lines of work initiated fall into three categories: (1) speeding up breeding by growing several generations in a single year by use of special growth chambers and other means, (2) broadening the genetic basis by importation of a wider range of material, including interspecific and intergeneric derivatives, and (3) development of synthetics compounded of phenotypically similar lines differing genetically in rust resistance. A small-scale project on the possibility of extracting valuable variants from irradiated seed from the USA is also under way.

2470 *Caldecott, R. S. The experimental control of the mutation process.* (*pp. 68–87*).

A report is given of investigations conducted at the University of Minnesota, using the barley Himalaya, to determine the influence of water content (4, 8 and 16%) on the radiosensitivity of seeds in relation to the following post-irradiation conditions: (1) duration of storage; (2) the presence of O_2 as opposed to that of N_2, H_2 or He during hydration immediately after irradiation; (3) duration of immediate hydration in O_2 or N_2; and (4) combination of storage in O_2 or N_2 for various periods and aerobic or anaerobic hydration. As indicated mainly by observations on seedling injury, postirradiation conditions affected sensitivity to X rays according to water content of the embryo. Reaction to thermal or fast neutron bombardment was not appreciably affected by water content or postirradiation conditions. Information is provided on genetical injury caused by different doses of X rays in relation to water content, the seeds being stored for 34 days before sowing. Per chromosomal aberration (reciprocal interchange), seeds with all three water contents gave rise to plants showing the same kind and same relative frequencies of chlorophyll mutations in the X_2. The absolute number of mutations and interchanges obtained at equal survival values was, however, about three times greater in plants from seeds with a water content of 16% than in those from seeds with either of the two lower contents.

2471 *MacKey, J. Mutagenic response in* Triticum *at different levels of ploidy.* (*pp. 88–111*).

In further experiments on the effect of chromosome number upon mutagenic response to radiation in cereals, dry seeds of *T. monococcum*, *T. dicoccum* and *T. aestivum* were exposed to X rays and fast neutrons. X-ray treatment caused a greater amount of extranuclear damage than neutron bombardment. Apart from this disparity the responses to the two types of radiation showed exactly the same trends at different levels of ploidy. As indicated by survival and fertility in the M_1 generation (plants immediately derived from seed subjected to mutagenic treatment), radioresistance increased with increasing number of genomes. The greater tolerance of the reduplicated gene system is evidently a more decisive factor in radioresistance than the higher degree of nuclear damage with increasing chromosome number. In the M_2, the yield of visible mutations was higher in 6*x* than 4*x* and 2*x* wheat. This result is attributed to genomic differentiation and greater tolerance of chromosomal alterations in *T. aestivum*. The mutations fall into four groups, in which chlorophyll production, ear type, straw height and physiological properties were respectively affected. With higher chromosome number, mutation tended to be characterized by a relatively higher frequency of dominant and partially dominant changes, distribution in clusters and a marked tendency to be unstable, these features being explicable on the basis of chromosomal alterations. Dominant and partially dominant mutations are considered to be mostly the result of inactivation of epistatic genes through deficiencies of various magnitudes. With increasing chromosome number, the mutation spectrum showed a pronounced shift from mutations interfering in the ability to complete the life cycle and reproduce

to those influencing more "peripheral" characters. The genetic system controlling vital characters has evidently undergone little evolutionary change at the 2*x* level. The polyploid species will thus tend to behave strictly as autopolyploids with respect to genes for vital characters, except for cases in which diploidization has had time to become established. The enhanced frequency of visible mutations in 6*x* wheat should not however be regarded as proof of an extremely high genetic dissimilarity of the added genomes with respect to peripheral characters. A strong phenotypic buffering at the polyploid level may be expected to restrict mutability so as to limit evolution to a narrower morphological range but allow "a more subtle differentiation".

2472 *Matsumura, S. Radiation genetics in wheat. Effects of ionizing radiations upon the germination of seeds and the growth of seedlings.* (*pp. 112–33*).

Drawing upon the results already published in a large number of papers, the author reviews work carried out by himself and his colleagues in Japan on the genetical effects of X and other radiations on *T. monococcum*.

2473 *Harrington, J. B. The FAO world catalogue of genetic stocks of wheat in operation.* (*pp. 135–40*).

The compilation, purpose and usage of the above catalogue are described. The view is expressed that the number of entries should be greatly increased and suggestions are made as to procedures likely to simplify the task of submitting descriptions of stocks to FAO.

2474 *Pugsley, A. T. The preservation of world genetic stocks.* (*pp. 140–42*).

Suggestions are made as to ways in which the preservation of genetic stocks of wheat may be put on a more systematic basis.

2475 *Reitz, L. P. & Ward, D. J. The U.S.D.A. world collection of wheat varieties and strains of interest to geneticists.* (*pp. 143–50*).

Steps in handling the USDA collection of wheats are explained and discussed.

An outline is given of work on barley to illustrate the attempt being made to secure information of a basic nature from the world collections of small-grain crops. An analysis of data classifying 6200 entries in the barley collection for 37 characters, comprising seven categories with respect to ear morphology, is nearing completion. Some characters, e.g. six rows, rough awns and covered caryopsis, occur in a large proportion of the strains, whereas others, e.g. purple kernels and awnless lemmas, appear in only a limited number. The predominant characters in each category may be observed in all possible combinations with the other individual characters and have been found in barleys from widespread geographical areas. Characters appearing in only a limited number of the entries were not however found in combination with several of the characters. The numerically secondary characters were often seen among strains with a fairly specific geographical origin. Several difficult problems of introgression have been encountered. Furthermore, it appears that some ear characters among the endemic barleys of Asia and Africa have had little opportunity to be associated with or to interact with one another. The analysis has not only indicated the regions where a search for certain ear characters is likely to be most fruitful, but it is also important from the evolutionary standpoint, since it does not point to Ethiopia as the centre of origin of some types, e.g. the two-rowed, smooth-awned or naked barleys, in spite of the considerable diversity of type in this country. It is suggested that in elucidating the origin of food crops, attention should be directed towards the centres of concentration for plant characters.

2476 *Riley, R. & Bell, G. D. H. The evaluation of synthetic species.* (*pp. 161–80*).

After outlining the new understanding of the natural polyploid species *Triticum vulgare*, made possible as the result of studying chromosome pairing in nullihaploid and 40-chromosome nullisomics deficient for the HH pair [cf. XXIX, 1381 and 3644], the authors discuss synthetic species in the Triticinae, mainly with reference to observations already published on forms examined at the Plant Breeding Institute, Cambridge, England. The material synthesized at this institute consists of 110 interspecific and intergeneric combinations constituting complete amphiploids, as well as partial amphiploids such as lines representing alien chromosome additions and substitutions. Emphasis has been placed on combinations between *Triticum* species and *Triticum* x *Aegilops*, but several *Triticum* x *Secale* and *Triticum* x *Agropyron* forms have also been examined. A review of observations on (1) the phenotypes and genetics and (2) the cytology and fertility of complete amphiploids of *Triticum* x *Triticum* and *Triticum* x *Aegilops* is followed by a discussion of procedures of using synthetic types in wheat improvement and of the value of such forms

from the practical point of view and in fundamental cytogenetical investigations.

2477 *Sánchez-Monge, E. Hexaploid* Triticale. (*pp. 181–94*).

The author reports data obtained on 6*x Triticale* during the past eight years at the Aula Dei Experimental Station, Spain [cf. XXVII, 375–6 and 391]. He deals with the parents used, various aspects of the crossability between 4*x* wheat species and rye, the colchicine technique applied to the F_1 hybrids, morphological and physiological characteristics of *Triticale* types involving *Triticum dicoccum, T. durum* and *T. dicoccoides*, the cytology of these three types and of 8*x Triticale aestivum*, and further breeding. The three 6*x Triticale* types show good vegetative vigour and usually the same degree of resistance to a given disease as the more resistant parent. Compared with their parents, they are later in maturity and intermediate in fertility. The types from *T. durum* and *T. dicoccum* are autogamous but *Triticale* from *T. dicoccoides* has a marked tendency towards allogamy. Cytological observations indicated that the univalents formed in *Triticale* are predominantly rye chromosomes and that the mechanism interfering with the formation of 7_{II} among the 14 rye chromosomes is equally effective in 4*x* and 6*x Triticale*. The most unfavourable characteristic in 6*x Triticale* is the poor grain formation, shrivelling affecting the seeds at a late stage, although the milky and waxy stages are normal. Breeding has been initiated in an attempt to improve grain quality. Crosses have been made between (1) different types of 6*x Triticale*, (2) 8*x* and 6*x Triticale* and (3) 6*x Triticale* and *T. aestivum*. In addition, seeds of *Triticale durum* have been X irradiated, by means of facilities in Sweden. Use may also be made of 6*x Triticale* in transferring genes from rye to wheat, as shown by the development of the wheat Terminillo [cf. XXIX, 1091].

2478 *Gaul, H. A critical survey of genome analysis.* (*pp. 194–206*).

Comments are made on the following means of studying interspecific and intergeneric relationships: morphological observation; data on pairing at metaphase I; serological techniques; the caryogram method; determination of the degree of preferential pairing in amphidiploids by cytological examination or indirectly in terms of fertility or segregation ratios; and study of the compensating effect of tetrasomes when crossed with the corresponding nullisomes. A more extensive discussion of the value of observations on meiotic pairing is then given. Amount of pairing is variable because it is controlled not only by structural homology but also by genic and environmental factors. Involving values for the total numbers of chiasmata, paired chromosomes and cells observed, a formula is presented which allows the calculation of the number of chromosomes able to pair, irrespectively of the amount of pairing observed by chance in the sample [cf. XXV, 907]. This formula has proved useful in studying pairing in *Triticum* x *Agropyron* and asynaptic rye and it may have a wider application. It is however stressed that the formula cannot be expected to be suitable in all cases, since, for example, it is based on the assumption that in each of the chromosomes able to pair, both arms are capable of forming chiasmata. Other problems in determining homologous relationships arise through the occurrence of pseudobivalents and "early separated bivalents" (loosely attached bivalents). Finally, it is pointed out that information on number of chromosomes able to pair gives none concerning degree of homology, since small homologous segments, as well as large ones, may lead to pairing. It is therefore concluded that the significance of data on pairing in genome analysis is limited and that for more precise information a combination of different methods is required.

2479 *Jakubziner* [*Jakubciner*], *M. M. New wheat species.* (*pp. 207–20*). (*Abst.*).

A review is presented of taxonomic work on diploid, tetraploid and hexaploid species, largely with reference to work in the USSR already published. Comments are also made upon the allopolyploids synthesized in the USSR, from the point of view of their value economically or in breeding.

The following suggestions are included concerning interspecific relationships, these opinions being partly stimulated by information recently reported on *T. spelta* in western Iran [cf. XXVIII, 1509]. The region of distribution of *T. spelta* in western Asia is now known to be considerable and to include the habitats of *T. dicoccoides* and *Ae. squarrosa*, i.e. both probable progenitors of this species. The region in question approaches the place of origin of *T. vavilovii*, viz. the mountains of Armenia, as well as being fairly close to the habitat of *T. macha*. A newly discovered form of *T. spelta* from western Iran shows some affinity with *T. macha* as regards type of ear brittleness. The view is expressed that the origin of *T. macha* is connected not with wild wheats and awnless

Aegilops species but with the 4*x* species *T. paleocolchicum* (= *T. georgicum*), to which it bears morphological resemblance. The origin of the 6*x* species *T. zhukovskyi* may be supposed to represent a parallel case, being connected with *T. timopheevi*. *T. vavilovii* and *T. spelta* are very probably related, as suggested by morphological affinities and the fact that the author has observed in many localities, particularly during 1958, that *T. vavilovii* has given rise to segregates of the *T. spelta* type.

2480 *Sears, E. R. The aneuploids of common wheat.* (*pp. 221–29*).

Chiefly with reference to published work by the author and M. Okamoto, an account is provided of the use of aneuploids of Chinese Spring in tackling the problems of homologies, pairing in haploid wheat, the asynaptic effect of chromosome V and identification of genome-A chromosomes.

Since it is now possible to assign each chromosome, with the possible exceptions of II and XIII, to its respective genome, the question arises as to the desirability of renumbering the chromosomes according to a logical system. It is suggested that the number of each of the seven homologous groups be used for all three chromosomes constituting the group in question, with the letters A, B and C added to distinguish the three.

2481 *Unrau, J. Survey of work with monosomics in Canada.* (*pp. 230–36*).

Notes are given outlining the objectives and progress of work on monosomic lines and lines with added, substituted or translocated chromosomes in research on wheat, rye and related genera at various institutions in Canada.

2482 *Shebeski, L. H. Speculations on the impact of the D genome.* (*pp. 237–41*).

The role played by genome D from *Aegilops squarrosa* in the productivity of wheat is considered. It is pointed out that *Ae. squarrosa* is a poor combiner. The synthesized tetraploid (AADD) between *T. monococcum* and *Ae. squarrosa* is decidedly inferior to *T. monococcum* and even more inferior to any well-adapted *T. durum* variety. The degree of polyploidy is evidently less important than the genomic combination. The synthesized hexaploid AABBDD does not show the productive capacity of the tetraploid AABB component. It could be argued that a newly synthesized hexaploid would be at a disadvantage. During the past four years in 458 yield trials in western Canada, however *T. durum* 'Stewart' outyielded the highest yielding bread wheats in well over 50% of the tests. It is suggested that breeders are now in a position to replace genome D by better combiners. In this connexion mention is made of two recently synthesized hexaploids, one combining AB with genome R from *Secale* and another combining AB with E from *Agropyron elongatum*. Both are outstanding in vegetative vigour but as yet no observations have been made on productivity.

2483 *Kihara, H. Japanese expedition to the Hindukush.* (*pp. 243–48*).

The author discusses his observations on wheat and *Aegilops* collected in Pakistan, Afghanistan and Iran. The results of a study of *Ae. squarrosa* strains are summarized [cf. XXIX, 3743]. Iran is considered to be the probable centre of origin of this species, the region around the Elburz mountains being tentatively regarded as the centre of origin of the highly primitive var. *meyeri*. In discussing the theory that 6*x* wheat originated from a cross between a wild 4*x* *Triticum* species and *Ae. squarrosa*, it is emphasized that hybrids of this nature have not been found in likely regions [cf. XIX, 2483], although it is believed that *Ae. squarrosa* was undoubtedly one of the ancestors. Applying Vavilov's hypothesis that dominant genes are frequent in the centre of origin, the following theory of the origin of 6*x* wheat is put forward. The 6*x* progenitor arose by hybridization in Transcaucasia and adjoining regions and may have been morphologically similar to *T. macha* and carried *S* (lax ear) and *C* (compact ear). *T. spelta* (*SScc*) and *T. compactum* (*ssCC*) originated from this form by mutation of *C* and *S*, respectively, to the recessive condition. Recombination between these two mutants would give *T. vulgare* (*sscc*). The three species thus derived from the initial progenitor were distributed in various directions from the centre of origin and in Iran *T. sphaerococcum* arose as a recessive mutant of *T. vulgare*.

2484 Dubrova, V. P.
(Changes in the grain setting in distant hybridization of wheat connected with the preliminary treatments of the maternal plants).
Učen. Zap. Belorussk. Univ. (Sci. Mem. White Russ. Univ.), 1957 : No. 37 : 237–54 : from Ref. Ž. (Ref. J.) 1958 : No. 17 : Abst. 76329 : 35–36. [Russian].

The grain sets of the hard wheats Melanopus 069 and Hordeiforme 010 from pollination by soft wheats such as Diamant [Diamond], 062 and Durable were improved by each of the following methods. (1) The hard wheat parent

was grown from seed resulting from supplementary pollination by soft wheat or rye; (2) the mother plants were sprayed with weak boric acid solutions; and (3) the germinating seed of the mother plants was subjected to temperatures just above or below zero.

2485 Pavličić, J.
Prilog nasledjivanju kompaktnosti klasa kod hibrida *Tr. vulgare* var. *ferrugineum* (Rumska Crvenka) x *Tr. turgidum* var. *plinianum* (Granata). (A contribution in the study of ear compactness of hybrids between *T. vulgare* var. *ferrugineum* 'Rumska Crvenka' x *T. turgidum* var. *plinianum* 'Branched wheat').
Arh. poljopr. Nauk. 1958 : **11** : No. 33 111–25.

The F_1 of the above cross was uniform and morphologically similar to the *T. vulgare* parent. Stable strains with increased number of spikelets per ear were not isolated up to the F_6. Branched forms appeared in the F_2 but they segregated into *T. vulgare* and intermediate types.

2486 Nakajima, G.
(External characters and somatic chromosomes of F_2 plants of Emmer wheat x rye).
Senshokutai (Chromsome)/Kromosomo 1959 : **40** : 1369–77.

F_2 progenies from crosses involving *Triticum dicoccum, T. durum, T. turgidum, T. persicum, T. polonicum, T. orientale* and *T. pyramidale,* on the one hand, and *Secale cereale, S. vavilovii, S. montanum* and *S. africum* were studied. Data are provided on spike characters and the somatic-chromosome complement. In the majority of progenies, the modal chromosome number was $2n = 42$. Aneuploidy was associated with reduced vegetative vigour and lower fertility.

2487 Watanabe, Y. & Mukade, K.
Cytogenetical studies on the intergeneric F_1 plants obtained by embryo-culture between *Triticum timopheevi* and *Secale cereale* and their open F_2 progenies.
Idengaku Zasshi/Jap. J. Genet. 1959 : **34** : 1–8.

Two F_1 plants ($2n = 21$) were secured from *T. timopheevi* x *S. cereale* with the aid of embryo culture. In the one F_1 plant examined meiotically, the modal configuration at metaphase I was $19_I + 1_{II}$. The 26 mature plants obtained by open pollination of the two F_1 individuals had $2n$ numbers ranging from 23 to 30, with the exception of one plant ($2n = 41$). From the observations on cytology, together with those on morphology and fertility, it was concluded that the F_2 plants, except for the one with $2n = 41$, were the result of natural back crossing with pollen from normal rye grown adjacent to the F_1 individuals and having accessories or X-ray induced translocations.

2488 Nakajima, G.
(Cytogenetical studies of trigeneric hybrids. II. Somatic chromosome numbers, external morphology and fertility of TperHRF$_1$ and TdurHRF$_1$).
Idengaku Zasshi/Jap. J. Genet. 1959 : **34** : 61–69. [Japanese].

Morphological and cytological descriptions are given of (*Triticum persicum* x *Haynaldia villosa*) x *Secale cereale* and (*T. durum* x *H. villosa*) x *S. cereale.* The chromosome numbers were 25–32 in the first cross and 24–32 in the second. Though the triple hybrids were highly sterile, a few viable grains resulted from natural selfing. [Cf. XXIX, 2455].

2489 Nakajima, G.
(Cytogenetical studies of trigeneric hybrids. III. Maturation division in pollen mother cells of TperHRF$_1$ plants with $2n = 28$ chromosomes).
Idengaku Zasshi/Jap. J. Genet. 1959 : **34** : 96–101. [Japanese].

The preceding abstract refers to observations on the chromosome numbers of the hybrid progeny of (*Triticum persicum* x *Haynaldia villosa*) x *Secale cereale.* The present paper describes meiosis in hybrids with $2n = 28$. The modal bivalent frequency was 2_{II}, the range being $0–6_{II}$; occasional trivalents were also found. It is inferred that the genomic constitution of the hybrids is ABVR.

2490 Watanabe, Y. & Mukade, K.
(Cytogenetical studies on intergeneric hybrids between wheat and *Agropyron.* II. Chromosome behaviour in first-generation backcross plants of *Triticum vulgare* Vill. x *A. glaucum* Roem. et Schult.).
Idengaku Zasshi/Jap. J. Genet. 1959 : **34** : 34–40. [Japanese].

Meiosis in F_1 plants of *T. vulgare* x *A. glaucum* and amphidiploid (*T. timopheevi* x *Aegilops squarrosa*) x *A. glaucum* has already been described [XXVIII, 1488]. In the present

paper, meiosis is described in 10 BF_1 plants obtained by crossing the first F_1 hybrid with *T. vulgare* and 1 BF_1 plant obtained similarly from the second F_1 hybrid. The $2n$ numbers of the BF_1 plants ranged from 46 to 66. Aberrations such as chromosome mosaicism, syncyte formation and, in the BF_1 from the second F_1, presence of telocentric chromosomes were frequent. The simple meiotic arrangement $25_{II} + 1I_I$ was observed however in one BF_1 plant from the first F_1. The BF_1 plants tillered profusely and were all resistant to *Puccinia triticina* '21B'.

2491 Vettel, F. K.
Mutationsversuche an Weizen-Roggenbastarden (*Triticale*). I. Mutationsauslösung bei *Triticale* Rimpau. [**Mutation experiments on wheat-rye hybrids (*Triticale*). I. Induction of mutation in *Triticale* Rimpau**].
Züchter 1959 : **29** : 293–317.

A high rate of mutation was induced by repeated X irradiation of successive generations. The X_2 and X_3 mutants described include forms with chlorophyll defects and others with abnormal ears, awns, grain or growth habit; there were also some early and late forms. A few mutants were superior to the original form in fertility and others had better grain quality or a firmer ear axis. Ten different mutants had a chromosome number of $2n = 56$. Details are given of the meiotic configurations found in the mutants; there were considerable differences in the number of abnormalities observed. Mutants with long compact ears combined good fertility with a high degree of stability in metaphase I but on the whole no clear relationships were found between fertility and the percentage of normal configuration in meiosis.

2492 Lewicki, S. & Ruszkowski, M.
Badania nad przemianą biotypów u pszenicy. Cz. III. (**Investigations on transforming biotypes of wheat. III.**).
Hodowla Roślin Aklimatyz. Nasiennictwo 1959 : **3** : 321–35.

Various cultivars of spring wheat were sown in autumn in 1954–57 together with certain mutants obtained from them by autumn sowing [cf. XXVIII, 1512–3]; two winter wheats, Markowicka and Kujawianka Wieclawicka, were grown as controls. The *erythrospermum* mutant from Ostka Polanowicka matured 2–3 days earlier than the initial variety and was almost as winter hardy as the two winter varieties; its yield of grain was greater than that of the parent variety but less than that of the winter wheats. The *ferrugineum* mutant of Ostka Chłopicka was equal to the winter wheats in both yield and hardiness, in both of which it exceeded the parent variety. Mutants from Podkowianka were inferior in hardiness but a winter form with unchanged morphological features was equal to the winter wheat controls in hardiness; these, and also the *erythrospermum* mutant, exceeded the winter wheats in grain yield. A *ferrugineum* mutant of Gentile Rosso was more hardy than the parent varieties and in certain years matured before the winter varieties and exceeded them in yield. The *lutescens* and *milturum* mutants of most varieties were inferior in both hardiness and yield.
The mutants were also sown in spring, with and without vernalization; the *ferrugineum* mutant of Ostka Polanowicka matured but was later than the parent variety after 45 days vernalization and failed to ear at all when unvernalized. The same applied to the *ferrugineum* mutants of other varieties, whereas most of the awnless mutants of awned varieties eared and matured at the same time as the spring parent.
The mutants all breed true and biometric observations showed them to be identical with their respective parents in most varietal characters. The promising ones can thus be released without further breeding.

2493 Suneson, C. A. & Jones, L. G.
Herbicides may produce instability.
Agron. J. 1960 : **52** : 120–21.

Evidence has been obtained at the University of California Agronomy Farm that soil application of dalapon (2,2-dichloropropionic acid) had mutagenic and gametocidal effects upon wheat and barley.

2494 Fujii, T.
Mutations in einkorn wheat induced by X-rays. V. Recovery of chlorophyll content in some mutants and double recessive segregants.
Idengaku Zasshi/Jap. J. Genet. 1959 : **34** : 261–67.

In further investigations [cf. XXIX, 2458] the author studied the recovery of chlorophyll content in the following double recessives when kept in a phytotron at 20° C., with illumination by fluorescent lamps: (1) *basi-viridis II - basi-viridis I*; (2) *basi-viridis II* - early; (3) *basi-viridis II* - slender; (4) *basi-viridis II* - irregular ear; (5) *basi-viridis II - striata*; and *chlorina-striata*. Compared with its parents, (1) showed

a further decrease in chlorophyll content, resembling *virido-albina*. Recessives (2), (3) and (4) were similar to the *basi-viridis II* parent in chlorophyll content. Mutants (1) to (4) recovered a normal green condition in the phytotron. In (5), the green stripes were of the *basi-viridis II* type, recovering a normal chlorophyll content. The white stripes did not disappear. The green stripes in (6) changed to the lighter green of the *chlorina* type. Type (6) showed no recovery. Observations on the effect of cutting off the green parts of the leaves of *virido-albina* suggested that a small amount of chlorophyll is necessary for initiation of recovery of chlorophyll content.

2495 Wisłocka, M. & Rozegnałowa, L.
Badania nad dziedziczeniem się gałęzistości kłosa wywołanej indukcją fotoperiodyczną u pszenicy jarej (*Triticum vulgare*, v. *lutescens*). [**Studies on the inheritance of ear branching caused by photoperiodic induction in spring wheat (*T. vulgare* var. *lutescens*)**].
Hodowla Roślin Aklimatyz. Nasiennictwo 1959 : **3** : 337–47.

No increase in the percentage of branched ears was detected after repeated induction by means of short photoperiods in three successive generations in the spring wheats Bajka [Fable] and Gorzowska Wczesna [Gorzowska Early], nor did the character become heritable.

2496 Naghiu, V.
Cîteva aspecte ale comportării formelor de grîu tare de primăvară (*Tr. durum* Desf.) obţinute în urma însămînţării acestuia în condiţii de mediu nespecifice. [**Some aspects of the behaviour of forms of spring hard wheat (*Triticum durum* Desf.) obtained after sowing under nonspecific environmental conditions**]
Lucrăr. şti. Inst. agron. Petru Groza Cluj 1958 : **14** : 125–35.

By subjecting *T. durum* var. *melanopus* to unusual sowing times, its hereditary basis is stated to have been shattered, resulting in the production of lines pertaining to *T. durum*, *T. vulgare*, *T. persicum*, *T. turgidum*, various intermediates and wheat-rye types. Principal attention is paid to the intermediates between *T. durum* and *T. vulgare*. A tendency in these for the development of awned spikelets, glabrous glumes, white ears and red grains in advanced generations is reported.

2497 Naghiu, V.
Crearea materialului iniţial în ameliorarea grîului prin folosirea condiţiilor de mediu nespecifice. (**The creation of initial material for wheat breeding by utilizing nonspecific environmental conditions**).
Lucrăr. sti. Inst. agron. Petru Groza Cluj 1959 : **15** : 111–16.

Further reference is made to the report that the heritable basis of *Triticum durum* var. *melanopus* has been shattered by sowing for 3 years at unusual times. Forms pertaining to *T. durum*, *T. vulgare*, *T. persicum* and *T. turgidum* and intermediates are stated to have resulted, some showing improvements in agronomic characters.

2498 Čeremisov, B. M.
(**The influence of conditions in autumn upon conversion of hard wheat into soft wheat**).
Agrobiologija (Agrobiology) 1959 : No. 2 : 285–87. [Russian].

An account of changing the hard-wheat varieties Melanopus 69, Rostov 25, Don Garnovka and Narodnaja [People's] into soft wheats at the Rostov Breeding Station is given. In the first year, the heritable basis of the hard wheats was shattered by sowing on 21 November. The grain from the shattered plants was then sown in the following year on 8 October, 23 October and 4 December. A table shows that the highest percentage of conversions was obtained from sowing on 8 October and the lowest from the sowing on 4 December.

2499 Sebök, C. M.
Contribuţii la problema educării hibrizilor de grîu prin metoda mentorului. (**Contributions to the problem of training wheat hybrids by the mentor method**).
Lucrăr. şti. Inst. agron. Petru Groza Cluj 1958 : **14** : 163–71.

Embryos of intervarietal hybrids of *Triticum aestivum* and of interspecific hybrids involving *T. aestivum* were transplanted on to endosperms of one (or the only) *T. aestivum* variety acting as parent in the cross. It is reported that in the F_2 of the intraspecific hybrids, the segregation ratios were shifted in the direction of the mentor variety on whose endosperm the hybrids had been grafted; the reverse tendency was noted in the F_2 of the interspecific crosses.

2500 Ryžej, I. P.
(The biological basis for a new method of wheat seed production).
Agrobiologija (Agrobiology) 1959 : No. 2 : 258–68. [Russian].
Hereditary improvement of wheat was obtained during seed production at Frunze, Kirgizia, by using only the seed from the central portion of the ear.

2501 Ciferri, R. & Bonvicini, M.
Revisione delle vecchie razze italiane in rapporto ai frumenti mediterranei. II.—*Triticum polonicum* L. e *T. turgidum* L. III.—*Triticum durum* L. **(A survey of the old Italian varieties in relation to Mediterranean wheats. II. *T. polonicum* L. and *T. turgidum* L. III. *T. durum* L.)**
Ann. Sper. agr. 1959 : **13** : No. 6 : Suppl. : lxxxvii–clxxix; 1960 : **14** : No. 1 : Suppl. : liii–cxix; **14** : No. 2 : Suppl. : lxiii–cxxviii.
Descriptions are given of the tetraploid wheats, adopting the same system as that used for the hexaploids [cf. 1405].

2502 Efrat, J. [Efrat, Y.], Azmon, I. ['Azmon, Y.] & Berkovitz, I. [Berkovits, Y.]
(Nursit Hazera 163, a new wheat selection).
Sadeh (Field)/Hassadeh 1959 : **39** : 991–92. [Hebrew].
This wheat was obtained by selection of local varieties. It pertains to *Triticum durum* var. *leucurum*. It yields well (203–90 kg./dunam*) and its grain weight and disease resistance are satisfactory.

2503 Erroux, J.
Introduction au catalogue des blés durs cultivés en Algérie. **(Introduction to the catalogue of hard wheats cultivated in Algeria).**
Bull. Soc. Hist. nat. Afr. N. 1958 : **49** : 124–42.
A discussion of the characters most useful as a basis for the identification of the main hard wheat varieties is followed by a simple key. Botanical descriptions and cultural characteristics of eight recommended varieties are given and specific recommendations are made for each of the principal wheat-growing regions of Algeria.

2504 Lebsock, K. L. & Stoa, T. E.
Two new durums, Wells and Lakota.
N. Dak. Fm. Res. 1960 : **21** : No. 3 : 4–6.
The release of Wells and Lakota, both from Sentry x (Ld379 x Ld357), is announced. Besides yielding well, they have shorter, stronger straw and more resistance to stem rust than established varieties. Wells, with moderately weak gluten and satisfactory test weight, has been allotted to the southern part of N. Dakota, and Lakota, with strong gluten and somewhat inferior test weight, to the northern districts.

2505 Lysholm, M. B.
"El Gaucho F.A." nueva variedad de trigo del Instituto Fitotécnico de "Santa Catalina". **(El Gaucho FA, a new wheat variety from the Santa Catalina Plant Breeding Institute).**
Rev. Fac. Agron. La Plata 1959 : **35** : 31–38.
Developed from Sinvalocho MA x (Riccio x Lin Calel), El Gaucho FA yields well, resists stem rust, leaf rust and loose smut and gives flour of very good quality. Data from the varietal trials in which it was tested are given for each of the four Argentine wheat subregions for which it is recommended.

2506 Erroux, J.
Note sur les blés des oasis du Sahara algérien. **(A note on the wheats of the oases of the Algerian Sahara).**
Bull. Soc. Hist. nat. Afr. N. 1958 : **49** : 180–95.
The problems of classification at the intraspecific level in the case of *Triticum vulgare* var. *oasicolum*, which name covers a multitude of diverse forms [cf. XXVI, 1161], are discussed in the light of recent work on the affinities of certain of these forms with Asiatic and other Saharan forms. Two type plants, chosen as representatives of the heterogeneous varieties broadly covered by the names Bel Mabrouk and Manga, are described and classified as *T. vulgare* var. *submeridionale inflatum*.

2507 Injakina, A. S.
(For expansion of the area under new hard-wheat varieties).
Selekcija i Semenovodstvo (Breeding and Seed-growing) 1959 : No. 2 : 48–50. [Russian].
Mention is made of Melanopus 26, Melanopus 1932 and Krasnokutka [wheat from Krasnyj Kut] which have been bred at Krasnyj Kut in

* 1 dunam = 0·23 of an acre.

recent years. They outyield older varieties such as Melanopus 69 and Hordeiforme 189, show improved resistance to drought and have large grains.

2508 KANIEWSKI, K.
Pszenica zwyczajna—*Triticum vulgare* Host. (Obraz zmienności gatunku). [**Bread wheat, *T. vulgare*, Host. (The variability of the species)**].
Rolnictwo, Warszawa 1957 : No. 1 : 5–50.

A review is given of the range of variation known in the bread wheats in respect of length of vegetation period, characters of the coleorhiza, coleoptile, seedlings and the various organs of the growing plant, ear and grain. The wide range of variation that can exist within a relatively small geographical area is illustrated by the wheats of Afghanistan, the details being cited from Vavilov and Bukinič. Reference is made to the view of Sinskaja that the species originated in Transcaucasia [cf. XXVI, 1149], though it is thought that further critical data are required before the question can finally be decided and that Sinskaja has accorded too little value to the experimental evidence of the production of *T. vulgare* from crosses of *Triticum* x *Aegilops*. On the other hand the close resemblance between the Swiss *T. antiquorum* and the Transcaucasian *T. protomacha* is seen as evidence that the bread wheats came to Europe from Transcaucasia. The majority of wheats belonging to *T. compactum* are regarded as more ancient than the common bread wheats; this species and *T. sphaerococcum* are seen as merely extending the range of variation of *T. vulgare*.

2509 SWAMINATHAN, M. S. & NATARAJAN, A. T.
Cytological and genetic changes induced by vegetable oils in *Triticum*.
J. Hered. 1959 : **50** : 177–87.

Dry seeds of *T. monococcum* 'Japanese Early', *T. dicoccum* 'Khapli' and *T. aestivum* 'C591' were soaked in peanut, mustard or castor oil, the duration of treatment being 6 hr. for the first two species and 24 hr. for C591. The oils induced chromosome and chromatid breaks, binucleate cells with or without synchronized mitosis and spindle abnormalities in the seedling root tips; "error" configurations at anaphase similar to those observed by LaCour and Rutishauser in *Scilla sibirica* were frequent in *T. monococcum* seedlings from seed treated with mustard oil [cf. XXV, 693]. Although reunion appeared to be rare during mitosis, multivalents and inversion bridges during meiosis indicated that delayed reunion may occur. Several morphological changes in the ear were observed in bread-wheat plants raised from the treated seed. One plant from peanut-oil treatment bore completely beardless ears but had the other characteristics of C591. No phenotypically detectable mutation occurred in the second-generation progenies of Einkorn and Emmer. Several mutant types appeared however in the second generation of C591, treatment with peanut oil leading to the highest number of mutations. While mutants with respect to ear characters predominated, some early, dwarf, grass-clump and *erectoides* mutants were found. The *erectoides* mutants may be of economic value. They were characterized by (1) decrease in the number of internodes, (2) a relatively shorter basal internode and longer uppermost internode and (3) increase in the cross-sectional area of the basal and middle internodes. These observations tally with those reported from Sweden [cf. XXVII, p. 590–1].

The above-mentioned awnless mutant was singled out for cytogenetical study. Meiotic abnormalities included deficiency-duplication configurations at pachytene, heteromorphic bivalents at metaphase I and chromosome mosaic cells. Awnless, long-tipped and fully-awned plants appeared in the selfed progeny. Among eight F_1 plants from awnless variant x C591 (fully awned), two were fully-awned, two long-tipped and four nonflowering grass clumps. The fully-awned F_1 individuals bred true. The F_2 from the long-tipped plants consisted of fully awned, long-tipped and awnless segregates in the ratio of 1 : 2 : 1. Meiotic observations on the three types of segregates indicated that they had inherited such changes as inversions, interchanges and deletions. All plants examined had $2n = 42$, with the exception of a grass clump ($2n = 40$) in the selfed progeny. Loss of awns was associated with a marked reduction in tillering and thus in yield. Deletion of the awn-producing genes of C591 is thought to be the most likely mode of origin of the awnless mutant. Since the data indicated that in genotypes free of inhibitors, alleles for awn production may show partial dominance in heterozygotes, the validity of the usual practice of assigning recessive *a* symbols to the series of genes promoting awn production is questioned. It is suggested that the rarity of naturally occurring bread wheats which are beardless simply because of lack of awn-conditioning genes may be explained by the considerable

reduction in yield associated with deletion of such genes.

2510 Tsunewaki, K. & Heyne, E. G.
Radiological study of wheat monosomics. I. Differential sensitivity of monosomic X and the disomic to X-irradiation.
Genetics 1959 : **44** : 933–46.

Differential sensitivity to irradiation in disomic and monosomic X populations of Chinese Spring was investigated over a wide range of X-ray doses. Dormant seeds were irradiated and survival percentage was recorded at first, second and fourth leaf stages of seedling development. Monosomic populations were found to be more sensitive to moderate radiation doses than were disomic. The X-ray doses necessary to kill 50% of the seedlings at the second-leaf stage were 45 and 33 Kr. for disomics and monosomics respectively, and, at the fourth-leaf stage, 44 and 32 Kr. respectively.
A 50% reduction in seedling height at the first-leaf stage was obtained with X-ray doses of 32 and 22 Kr. for disomics and monosomics respectively. Differential mutation rates, segregation of mutant characters within a plant and differential frequencies of speltoid and awned mutants are described. The use of irradiated monosomics as a means of studying the functional importance of individual chromosomes and for screening recessive mutants is discussed.

2511 Tsunewaki, K. & Heyne, E. G.
Radiological study of wheat monosomics. II. Differential sensitivity of 16 monosomics and the disomic to a single dosage of X-irradiation.
Genetics 1959 : **44** : 947–54.

Dormant seeds of 16 monosomics were subjected to 14 Kr. units and compared for effect on percentage germination, seedling height at first leaf stage, and on the number of tillers produced. From the results obtained, similarity or divergence of function is deduced for the chromosomes belonging to different homeologous groups.
"Germination rates of monosomics II and XIII, both of which belong to homeologous group II, were most increased and reduced, respectively, indicating a functional divergence of the corresponding homeologous chromosomes on germination. X-ray damage on seedling height was most pronounced in monosomics X, XV, III and XVI. Monosomics III and XVI belong to homeologous group III, indicating a similar function of the corresponding chromosomes on the leaf development of seedlings. Monosomics IV, VIII, and XV, all of which belong to homeologous group IV, were concerned with tillering. Monosomic IV was significantly resistant to irradiation effects while the other two were sensitive." These results are evaluated against Sears's work [cf. XXIV, 1005] on nullisomics.

2512 Pai, R. A. & Swaminathan, M. S.
Cytological behaviour of a nullihaploid of bread wheat.
Naturwissenschaften 1959 : **46** : 584–85.

A nullihaploid found in the progeny of the bread wheat NP798 treated with S^{35}, the dose being 5 μc per seed, showed good vegetative growth but the leaves and stem were thin and the pollen was almost completely sterile. During microsporogenesis, many cells had their 20 chromosomes as univalents; in one cell five bivalents were observed. The mean number of associations per cell was $0{\cdot}01_{IV} + 0{\cdot}03_{III} + 0{\cdot}67_{II} + 18{\cdot}53_{I}$. Most bivalents were of the rod type with a single chiasma in one arm. Sixty-one of the 504 cells analysed showed abnormalities such as polyploidy, nonsynchronization of chromosome condensation and fragmentation. Twenty-eight cells had 21 chromosomes, two had 22 and two had 23. Several cells had sticky chromosomes. Since the mean number of primary associations in this nullihaploid is not very different from that characteristic of euhaploids, the nullihaploid must lack some chromosome other than the HH chromosome of Riley and Chapman or the chromosome V of Sears and Okamoto, which are thought to carry genes restricting pairing to homologous chromosomes. Secondary associations were observed in the nullihaploid and the end-to-end type showed a Poisson distribution but the end-to-side type did not. With the side-to-side association, the fit to a Poisson distribution was good when no bivalents or two bivalents were present but with one bivalent there was not a good fit.

2513 Prugar, J.
Výsledky průzkumu obsahu vitaminu B_1 v našich pšenicích. (**The results of an investigation of the vitamin B_1 content of our wheats**).
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 115–20.

A series of Czechoslovakian varieties was investigated and it was found that the thiamin content of the grain varied considerably in different localities. The best winter varieties as

regards thiamin content were Kaštická bezosinná [Kaštice Awnless], Košutská [wheat from Košut] and Dobrovice 10; the best spring variety was Podbořanka.

2514 Starzycki, S.
Badania zależności niędzy zawartością wody i białka w liściach a przebiegiem formowania ziarna u kilku odmian pszenicy ozimej. (**Studies on the correlation between water and protein content of the leaves and the course of grain formation in some winter wheat varieties**).
Hodowla Roślin Aklimatyz. Nasiennictwo 1959 : **3** : 491–506.
Among 12 varieties, differences were found in rate of loss of water 10–15 days after flowering and in time of withering, neither character being closely correlated with earliness. Varieties also differed in intake of water by the leaves during rainfall. Water content showed no relation to yields of grain or straw. Relative protein content of the leaves varied according to variety and was inversely related to relative water content; this character appeared to be related to earliness, early varieties having a lower protein content in the withered leaves.

2515 Stroun, M. & Pugnat, C.
Action de l'hivernage sur le blé tendre de printemps "Lichti-früh" (*Triticum vulgare*). [**The effect of wintering on the soft spring wheat Lichti-früh (*T. vulgare*)**].
Ber. schweiz. bot. Ges. 1959 : **69** : 5–15.
After two successive sowings in autumn and late summer, plants of Lichti-früh [Lichti Early] had a prolonged photostage similar to that of winter wheat but the thermostage was unchanged. Natural selection was not responsibe for this result.

2516 Takeuchi, S. & Hasegawa, H.
(The effect of soil temperature on the growth of crop plants. V. The effect of temperature on the productivity of wheat varieties).
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1959 : **28** : 213–16. [Japanese].
Ten varieties differing in their degree of winter habit were grown at winter soil temperatures of 6 and 11° C. Leaf emergence and leaf number were raised by the higher temperature, the increase being greater in varieties with a more pronounced winter habit. Maturation date was advanced by the higher temperature, this effect being most marked in varieties with a less pronounced winter habit.

2517 Gfeller, F. & Svejda, F.
Inheritance of post-harvest seed dormancy and kernel colour in spring wheat lines.
Canad. J. Pl. Sci. 1960 : **40** : 1–6.
Inheritance of the above characters was studied in F_7 lines of a cross between the dormant-seeded red spring wheat Renown and nondormant white spring wheat Cascade. A heritability value of 73% was obtained for dormancy. Inheritance of testa colour was controlled by three pairs of duplicate genes. Red testa was associated with dormancy, none of the lines with white kernels being dormant. The genes for testa colour may therefore also control dormancy. Moisture content affected degree of dormancy. Significant differences in dormancy were however detected between red-kernelled lines similar in moisture content. Possibly lines with a greater number of genes for testa colour may be the more dormant. Phenol colour reaction was monogenically controlled and independent of dormancy.

2518 Țîbulko [Cybul'ko], V. S.
Adîncirea nodului de înfrățire la grîul de toamnă prin metoda selecției. (**Increasing the depth of the tillering node in winter wheat by means of selection**).
An. Romîno-Soviet. : Ser. Agric.-Zooteh. 1959 : **13** : No. 1 : 43–49.
[Cf. XXIX, 280].

2519 Grodecký, V.
Vliv odnožováni jarní pšenice na výnos zrna. (**The influence of the tillering of spring wheat on the seed yield**).
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 343–60.
An increase in the number of tillers was found to be accompanied by an increase in the number of grains and the weight of grain produced by the whole plant; the 1000-grain weight of the plant decreased when there were more than three or four tillers. The number of grains and the weight of the grain of the main stem also

increased when the number of tillers rose and the 100-grain weight of the main ear either rose or showed an insignificant decrease. Spring wheats differed in their tillering capacity, that of Vega and Vesna [Spring] being greater than that of Ratbořská.

2520 Tribunskaja, A. Ja.
(Phosphorus content of the grain of spring wheats).
Selekcija i Semenovodstvo (Breeding and Seed-growing) 1959 : No. 2 : 68–69. [Russian].
The soft wheats Diamant [Diamond], Iskra [Spark], Caesium 111 and Udarnica [Shock Worker] and the hard wheat Leucurum 33 were distinguished by a high phosphorus content compared with other cultivars tested in the province of Sverdlovsk. *Aegilops triuncialis*, *Triticum dicoccoides* var. *spontanico-nigrum*, *T. monococcum* and other wild or primitive species of wheat were even richer in phosphorus than the above cultivars and it is thought that these forms might be usefully employed in breedng hard and soft wheat for improved grain quality.

2521 Hall, O.
Immuno-electrophoretic analyses of allopolyploid ryewheat and its parental species.
Hereditas, Lund 1959 : **45** : 495–504.
Extracts from seeds of the wheat Östgöta 01440, Stålråg [Steel rye] and the allopolyploid involving these two varieties were subjected to electrophoretic and immunoelectrophoretic analyses. Identity was established between some of the proteins in the wheat and rye extracts. The *Triticale* extract contained all the proteins identified in the wheat extract and, with one exception, all those detected in the rye extract.

2522 Lju, D.-C. [Liu, T.-T.].
(Microscopical observations on mutual interaction between pollen grains).
Agrobiologija (Agrobiology) 1959 : No. 2 : 288–91. [Russian].
The pollen of one wheat variety or pollen mixtures of several wheat varieties or of wheat and rye were cultured artificially at the Timirjazev Agricultural Academy. It was found that pollen grains secreted, upon contact with other pollen grains, a liquid substance which promoted pollen growth; the contents of damaged pollen grains also promoted the growth of pollen tubes.

2523 Larson, R. I.
Inheritance of the type of solid stem in Golden Ball (*Triticum durum*). II. Cytogenetics of the relation between solid stem and other morphological characters in hexaploid F_5 lines of a hybrid with Rescue (*T. aestivum*).
Canad. J. Bot. 1959 : **37** : 1207–16.
Analysis of selected F_5 segregates of the pentaploid hybrid Rescue (*T. aestivum*) x Golden Ball (*T. durum*) showed that chromosome XVI of Rescue possesses a gene or genes inhibiting pith production, especially in the top internodes. Three 42-chromosome segregates were more solid at the top internode than Rescue. As they have the D genome of Rescue their increased solidity is due to segregation in the A and B genomes. Although further selection may increase stem solidity it seems unlikely that lines with stems as solid as those of Golden Ball will be produced.

2524 Kaniewski, K. & Dalkiewicz, H.
Badania porównawcze nad budową okrywy owocowej ziarniaków pszenicy. **(Comparative investigations on the structure of the pericarp of wheat grains).**
Roczn. Nauk rol. : Ser. D 1959 : **84** : Pp. 107.
Details of the structure of the pericarp (omitting the furrow) are reported for (1) species with the grains firmly enclosed in the spikelets and (2) those with loosely set grains. In group (1), lignification may be entirely absent or confined to a few spots in the epicarp; in *T. spelta* lignification of the tube and cross cells occurs rarely. In group (2), marked lignification of the cross and tube cells is seen in some species and varieties but not others; the group is, however, distinguished by a clearly marked basal layer of the epimesocarp which stains violet with $ZnCl_2 + I_2$. The observations show that *T. polonicoides* and *T. pseudopolonicum* are distinct from *T. polonicum* in epicarp structure and together with other data suggest that the two former species are closely related or identical. The present work also provides further evidence of similarities between *T. polonicoides* and *T. dicoccum* and between *T.*

polonicum and *T. durum* [cf. XXVII, 1581 and XXX, 290].

2525 Jakubciner, M. M.
A contribution to the knowledge of the wheats of China.
Bot. Ž. (Bot. J.), Moskva 1959 : **44** : 1425–36. [Russian].

Details are given of some recent collections of wheat from different parts of China. They include winter forms of *Triticum durum*, awnless forms of *T. durum*, *T. turgidum*, *T. polonicum* and *T. compactum*, spring and winter forms of *T. turgidum*, dwarf forms of *T. turgidum*, and unusual awned forms of *T. turanicum*. Several subspecies of *T. aestivum* from China and Tibet are described, including truly awnless forms and wheats with branched ears, black glumes and ears with an unusually large number of grains. Most of the Chinese wheats are distinguished by earliness, particularly the winter varieties, which have a particularly short thermostage in phasic development. Many of them have 5, some 6–7, grains per spikelet and give exceptionally high yields. Some have short straw, though in only a few is the straw of more than average strength; other useful characters found in Chinese wheats are freedom from shedding and resistance to brown and yellow rust, smut, mildew, *Fusarium* spp., drought and heat.
Reference is made to some of the wheats recently bred in China and to the role played by Chinese wheats in breeding improved varieties in Italy, Argentina and elsewhere.

2526 Gotoh, K. & Osanai, S.-I.
Efficiency of selection for yield under different fertilizer levels in a wheat cross.
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 173–78.

F_2 plants and F_3 lines of the winter-wheat cross Minturki x Tohoku 103 [North-east 103] were selected for yield under three conditions of fertilizer application: (1) half, (2) standard and (3) double amounts. In the F_4, the 15 groups of selected lines (three lines per progeny) were each subjected to all three levels of fertilizer. Superior F_4 lines, with wide adaptability to fertilizer conditions, were more frequently found in material selected under application (1) than among lines derived from the other two treatments. In addition, heritability values for yield and ear number in lines from (1) were very much higher.

2527 Ždanov, A. P.
(Studying the causes of reduced field viability of the seed and the loss of plants).
Selekcija i Semenovodstvo (Breeding and Seed-growing) 1959 : No. 2 : 52–53. [Russian].

A table shows the percentage of viable seed for several winter-wheat varieties tested in different districts of the Stavropol' territory from 1952 to 1957. A discussion of what might cause reduced viability and the resulting loss of plants is invited.

2528 Kretschmer, G.
Ein neues Verfahren für die Bestimmung der Kälteresistenz von Getreide. (**A new procedure for the determination of the cold resistance of cereals**).
Wiss. Z. Univ. Jena : Math.-Naturwiss. Reihe 1958–59 : **8** : 445–48.

In the method described the seedlings to be tested are removed from the plots and the leaves and roots cut away to 1·5 cm. above and below the grain. The stumps are then placed in a cold chamber for 2 hr. and then in a room at 10° C. for three days. The percentage of stumps which fail to show any growth is determined and the temperature of 100% killing is taken as the frost-resistance value. Arrangement of wheat varieties according to this value agreed well with ranking according to their known resistance. The order was almost identical with each repetition but the magnitude of the differences between varieties varied at different times. Variation in frost resistance value was correlated with the ground temperature on the date at which the plants were lifted.

2529 di Martino, V.
Razze elette di grano a confronto nei terreni asciutti. (**Selected wheat varieties compared on dry soils**).
Agric. bresciano 1959 : **7** : No. 41 : p. 2.

A comparison of six cultivars was made in the vicinity of Lake Garda in 1958–59, a report being given of their behaviour in each successive month from the time of sowing. The earliest to ear was Fortunato, which also gave the highest yield, amounting to 44·75 c. per ha. The next in order of yield were Mara with 40·82 c. and S. Pastore 14 with 38·12 c., whereas the newer varieties Funone, Leone [Lion] and Generoso 7 [Generous 7] were all inferior.

2530 Fajersson, F.
Kan höstvetet bli ännu stråstyvare? (**Can winter wheat be made even stiffer strawed ?**)
Weibulls Årsb. Växtföräd. Växtodling 1960 : **55** : 11–13.

Data are presented showing the superiority in straw strength of Starke over Svale, Skandia IIIB and Øtofte L56. W15598, which is still under trial, has even stronger straw than Starke and shows less decrease in strength during ripening.

2531 Michalik-Skucińska, B. & Miszke, W.
Z badań nad wyleganiem zbóż. (**Studies on lodging in cereals**).
Hodowla Roślin Aklimatyz. Nasiennictwo 1959 : **3** : 121–42.

A negative correlation was established in five spring wheats between lodging resistance on the one hand and size and frequency of the parenchymatous areas visible in transverse section in the sclerenchymatous ring of the stem, on the other. Varietal differences are most marked in the second internode below the ear.

2532 Pirson, H.
Prüfung verschiedener Winterweizensorten auf Anfälligkeit gegen *Septoria nodorum* Berk. mit Hilfe von künstlichen Infektionen. (**Testing different winter wheat varieties for susceptibility to *S. nodorum* Berk. with the aid of artificial infection**).
Phytopath. Z. 1960 : **37** : 330–42.

Several varieties widely cultivated in Schleswig-Holstein were tested; it was found that a uniform attack could be obtained by spraying the plots with a suspension of spores. The number of spores formed and the 1000-grain weight were determined for each variety. Some varietal differences in susceptibility were discerned. On the whole, early varieties were less damaged than late varieties but with early infection all varieties suffered equally. There are so many environmental factors, such as nitrogen manuring, influencing resistance that long-term varietal tests are necessary.

2533 Borisenko, S. I.
(**A method which improves the resistance of wheat to smut**).
Selekcija i Semenovodstvo (Breeding and Seed-growing) 1959 : No. 2 : 40–41. [Russian].

Improvements in resistance to smut and bunt, said to be heritable, were obtained in Narodnaja [People's], Hordeiforme 48–2, Hordeiforme 46 and Otečestvennaja [Fatherland] by hot-air treatments of the seed for several successive generations. The treatment at 45° C. for 4 hr. is specially recommended.

2534 Simon & Croisier
Appariton d'une nouvelle race de charbon du blé en France. (**The appearance of a new race of wheat smut in France**).
CR Acad. Agric. Fr. 1959 : **45** : 790–92.

A new race of *Ustilago tritici* designated Cappelle has been observed on the following varieties: Cappelle Desprez, Heurtebise Blondeau, Marne Desprez and Alsace 22. Blé des Dômes, Maître Pierre and Vilmorin 27, which are more or less susceptible to race Vilmorin 27, are also attacked by the new race although the damage sustained is less severe. Four varieties resistant to the new race are Élite Lepeuple, Étoile de Choisy [Choisy Star], Vilmorin 23 and Hybride de Bersée.

2535 Zaleski, K. & Grela, T.
Względna odporność 15 odmian pszenicy ozimej, uprawianych w Polsce, na śnieć pszenicy (*Tilletia tritici* [Bjerk.] Winter). Doświadczenia polowe z lat 1950/51. [**The relative resistance of 15 winter wheat varieties, cultivated in Poland, to wheat bunt (*T. tritici* [Bjerk.] Winter). Field trials, 1950/51**].
Poznań. Towarz. Przyjaciół Nauk Wydział mat.-przyrod. Prace Kom. Nauk roln. Leśn. 1959 : **5** : No. 4 : Pp. 19.

In the above tests, Biała Kleszczewska [White Kleszczewska] was very resistant, Antonińska Wczesna [Early Antonińska] moderately resistant, Biały Krzyż [White Cross] and Kujawianka Więcławicka moderately susceptible, and the rest, including the most productive varieties, highly susceptible.

2536 Kendrick, E. L. & Holton, C. S.
Differential longevity of teliospores of pathogenic races of *Tilletia caries* and *T. foetida*.
Phytopathology 1960 : **50** : 51–54.

Marked differences were observed in the longevity of spores of different pathogenic races of *T. caries* and *T. foetida* in viability tests on 11, 18 and 22-year-old teleutospore samples.

2537 Rădulescu, E.
Cu privire la metodica infecțiunilor experimentale cu malură grîului - *Tilletia foetida* (Bauer) Liro. (**On the technique of experimental infection with wheat bunt, *T. foetida* (Bauer) Liro**].
Lucrăr. şti. Inst. agron. Petru Groza Cluj 1959 : **15** : 147–59.

The following technique is recommended for

testing varietal reaction: sowing grain to which 2%* by weight of spores had been applied in the field 7 cm. deep and at a density of 700 grains/m.^{2} at a temperature of 5–15° C. during germination. Infestation is helped by covering the plants 4 days after emergence.

2538 Johnston, C. O.
Principal commercial varieties of wheat grown in the United States, their reactions to rusts, and source of rust resistance shown.
Robigo, Castelar 1959 : No. 7 : 10–11; also in Spanish, 12–13.

Details of the resistance to leaf and stem rusts and the source of resistance are given in tabular form for the main varieties grown in different regions of the USA. It is noted that stripe rust has appeared in the western Mississippi valley and that there is some evidence that varieties related to or derived from Turkey are less severely attacked than others.

2539 Kivi, E. I.
Notes on the incidence of wheat stem rust (*Puccinia graminis tritici*) at Tammisto in the summer of 1958.
Maataloust. Aikakausk. 1959 : **31** : 90–93.

Observations on the incidence of wheat stem rust in Finland in 1958 have been made and compared with that in 1951, the last season in which there was an epidemic. Only 2 varieties, Cascade and Selkirk, escaped contamination in 1958. Canus was very resistant in 1958 but susceptible in 1951. Of the Tammisto material, Tëra [Blade] and line Ta4072, derived from Jyvälahti x Ta752, were highly resistant, as was also the Russian line K32084.
The average resistance of pedigree material derived from American varieties is given. Victory x Ta323 and Mida x Ta189 were most resistant, and in F_2 generations, Ta4721 x Selkirk and Ta4690 x Regent were superior.

2540 Luig, N. H.
Differential transmission of gametes in wheat.
Nature, Lond. 1960 : **185** : 636–67.

Investigators in Australia and North America have found that Gabo, Yalta, Charter, Lee and Timstein carry the same resistance to stem rust. Reports differ, however, as to the mode of inheritance of resistance. Workers in North America, using Chinese Spring as susceptible parent, found evidence of the dependence of resistance upon two linked, dominant and complementary factors (*Sr*11 and *Sr*12) [cf. *XXVII*, 439]. Australian workers, on the other hand, using crosses with Federation, concluded that resistance was controlled by a single gene [cf. XX, 897 and XXVII, 1637]. Most of the data reported in the present communication were derived from the F_2 and F_3 of crosses involving Gabo, Yalta, Charter, Eureka and Mentana, the last two varieties being used as stem-rust susceptible parents. Mentana is resistant to strain 68Anz–3 of leaf rust. Failure to secure susceptible segregates in F_2 intercrosses confirmed that Gabo, Yalta and Charter have the same gene or genes for resistance to race 126 of stem rust. In crosses of these three varieties with Eureka, a single dominant gene apparently segregated. Crosses with Mentana, however, gave results similar to those reported by North American workers. They did not fit a single-factor hypothesis and in Yalta x Mentana a 1 : 1 ratio was obtained. Similarly, in studies of leaf-rust resistance, inconsistencies were found in the F_2 segregation of crosses involving Mentana and Eureka, Spica, Kenya 117A, Gabo, Charter and Yalta. Data are given on the reaction of the F_3 of Gabo x Mentana and Yalta x Mentana to strains 126Anz–1 of stem rust and 68Anz–3 of leaf rust. In both crosses close linkage in the repulsion phase between stem-rust and leaf-rust resistance was evident, while the different segregation ratios in the two crosses were indicative of differential transmission of gametes. A striking feature of the F_3 ratio of Yalta x Mentana was the low proportion of homozygous stem-rust resistant lines. This, like the F_2 ratio of 1 : 1, could be explained by partial failure of pollen carrying the dominant allele. In many F_3 lines, however, a considerable excess of susceptible segregates occurred; a second test of 14 lines confirmed this behaviour. Differential transmission therefore also operated in the gametes. A back cross of Mentana x (Yalta x Mentana) tested with stem rust gave 2 resistant and 11 susceptible plants. The two resistant individuals, when selfed, produced progeny with a ratio of 2·2 resistant : 1 susceptible, instead of the expected 1 : 1. The author's results therefore support the suggestion that the Gabo type of stem-rust resistance depends upon only one gene. It is also considered likely that Mentana carries only one major factor for leaf-rust resistance. The main basis for these assumptions is the relative infrequency of crossing over in the repulsion phase. No

* Erroneously given as 25% in the English summary.

evidence was obtained that the results from crosses with Mentana were influenced by partial sterility or differential zygotic viability.

2541 Vallega, J.
Behaviour of the cultivated varieties with respect to variation in parasitic populations.
Robigo, Castelar 1959 : No. 8 : 8–9; also in Spanish 7–8. (Mimeographed).

With special reference to wheat rusts, the dangers of growing crop varieties with a limited range of resistance towards a highly variable pathogen are pointed out. Possible solutions include: (1) developing varieties carrying several different resistance factors, (2) growing a mixture of varieties all carrying different resistance factors; (3) growing a mixture of varieties which may or may not be resistant but are sufficiently variable to prevent the spread of the parasite; and (4) growing the greatest possible number of varieties differing in type of resistance and changing them frequently, so that the pathogen has little opportunity to multiply.

2542 Hassebrauk, K.
Physiologic races of wheat stripe and leaf rusts in Germany.
Robigo, Castelar 1959 : No. 8 : 11–12; also in German, p. 10; and Spanish, 12–13. (Mimeographed).

Seven races of yellow rust and 18 of leaf rust found in Germany are listed and notes given on their distribution and prevalence.

2543 Lelley, J.
Adatok egyes magyar őszi búzafajták és keresztezési származékok levélrozsda rezisztenciájáról. (**Data on the leaf-rust resistance of some Hungarian wheat varieties and hybrid progenies**).
Növénytermelés 1959 : **8** : 315–24.

In tests of nine breeding lines and five commercial varieties, material showing resistance to artificial field infection with two races of *Puccinia triticina* referred to as R1 and R2 was also resistant to both races under greenhouse conditions. Material selected for field resistance to only one race was only rarely resistant to both races in the greenhouse. Among the commercial lines, only Fertőd 293 was resistant to the prevalent race R1 and none was resistant to R2. The popularity of Fertőd 293 is regarded as a probably important factor in increasing the spread of R2 [cf. 2544].

2544 Bócsa, I. (Mrs.).
A búza szár- és levélrozsda fiziológiai specializálódása Magyarországon 1956-ban. (**Physiological specialization of stem and leaf rusts of wheat in Hungary in 1956**).
Növénytermelés 1959 : **8** : 325–32.

The relative frequencies of stem-rust races 21, 40 and 14 in Hungary were 76, 16 and 8% respectively. For the leaf-rust races 20 and 77 the frequencies were 79 and 21%; the latter race appears to be spreading rapidly [cf. 2543].

2545 Basile, R., Leonori-Ossicini, A. & Levine, M. N.
Another rare parasitic race of *Puccinia graminis tritici* of possible scientific interest.
Robigo, Castelar 1959 : No. 9 : 22–23; also in Italian, 19–20; and Spanish, 20–21. (Mimeographed).

A sample of *P. graminis* var. *tritici* from Badia Polesine, Venice, in 1955 has proved closely similar in its behaviour on 12 standard differential wheats to race 20, previously known only from a sample isolated in Alabama in 1918.

2546 Spehar, V.
Physiologic races of *Puccinia graminis* var. *tritici* in west part of Yugoslavia in 1957 and 1958.
Robigo, Castelar 1959 : No. 9 : 23–24; also in Spanish, p. 24. (Mimeographed).

The frequencies of different races as determined in 1957 and 1958 are listed.

2547 Green, G. J. & Samborski, D. J.
Physiologic specialization in the wheat rusts in Canada.
Robigo, Castelar 1959 : No. 7 : 1–3; also in Spanish, 3–5.

The distribution of races of stem and wheat rust in Canada is mapped and tables are given showing (1) the reactions of supplementary differential host varieties to several subraces of stem rust and (2) the sources of stem-rust resistance used in breeding at Winnipeg.

2548 **The physiologic race survey of *Puccinia graminis* var. *tritici* and *P. graminis* var. *avenae* in the United States in 1957.**
Robigo, Castelar 1959 : No. 7 : 7–8; also in Spanish, 8–9.

[Cf. XXIX, 255].

2549 Johnston, C. O.
The present status of physiologic races of the leaf rust of wheat in the United States.
Robigo, Castelar 1959 : No. 7 : p. 9; also in Spanish, p. 10.
[Cf. XXIX, 2519].

2550 Johnston, C. O.
Physiologic races of the leaf rust of wheat, *Puccinia recondita* Rob. ex Desm., in the United States in 1958.
Plant Dis. Reptr. 1959 : **43** : 998–99.
In 1958, 28 races were isolated from 28 States in the USA. Race 15 was the most abundant for the second year in succession, representing 31·1% of the total present in 22 states. Following in prevalence were races 5, 122, 2, 11 and 6. In the Pacific coastal region, 11, 26, 131, 1 and 53 were most abundant. Races 6, 28, 105 and 126 prevailed in the north-central region.

2551 Roane, C. W., Stakman, E. C., Loegering, W. Q., Stewart, D. M. & Watson, W. M.
Survival of physiologic races of *Puccinia graminis* var. *tritici* on wheat near barberry bushes.
Phytopathology 1960 : **50** : 40–44.
The ability of different physiological races to survive and increase in mixed race populations was investigated using susceptible host varieties to eliminate varietal screening. Forty-two races appeared during the four years of the trial. Races 38 and 56 demonstrated great survival ability, while races 23A, 48, 69 and 186A failed to become prevalent. Races 14, 15B and 23 were intermediate in this respect.

2552 Vallega, J. & Cenóz, H. P.
Variation in the population of *Puccinia graminis tritici* in Argentina in the period 1938-1958.
Robigo, Castelar 1959 : No. 9 : 17–18; also in Spanish, p. 17. (Mimeographed).
A graph showing the relative frequencies of race groups 11, 42, 15 and 17 in Argentina over the period 1938–58 is presented and it is noted that in recent years race 17G has become prevalent, attacking the previously resistant wheats Tezanos Pinto Criollo MAG, Magnif Entrerriano MAG, Pergamino Gaboto MAG and others. Within the race group 15, a race occurs which under some conditions is virulent on seedlings of Baladi 116 [Local 116], a *Triticum durum* variety normally regarded as a good source of stem-rust resistance.

2553 Heermann, R. M.
Inheritance of stem rust reaction in tetraploid wheat hybrids : II. Genes for resistance to race 15B from Khapli emmer.
Agron. J. 1960 : **52** : 107–10.
Data on the F_1–F_3 of crosses involving Khapli, *Triticum durum* 'Stewart' and three derivatives of *T. durum* x Khapli showed the seedling resistance of Khapli to race 15B to be under the control of two independent dominant genes. The adult-plant resistance of Khapli was determined by at least four independent genes, two of which were partially dominant and two recessive. The genes for seedling resistance and the two partially dominant genes for adult resistance were identical or closely linked.

2554 Pugsley, A. T.
Interaction of genes governing resistance to *Puccinia graminis tritici*.
Robigo, Castelar 1959 : No. 9 : p. 18; also in Spanish, 18–19. (Mimeographed).
The wheats CI12633 and PI170913 both appear to be derivatives of *Triticum timopheevi* and both are resistant to races 126Anz2 and 222Anz3, which attack Eureka and several other varieties carrying *Sr*6. When crossed with susceptible varieties, CI12633 and PI170913 always yield resistant F_1 seedlings, unless Eureka is used as the susceptible parent, in which case the F_1 seedlings are susceptible. It is suggested that there is an interaction between a gene or genes in the *T. timopheevi* derivatives and a gene or genes in Eureka other than *Sr*6. Such an interaction might be useful in identifying the *T. timopheevi* type of resistance.

2555 Holmes, N. D. & Peterson, L. K.
The influence of the host on oviposition by the wheat stem sawfly, *Cephus cinctus* Nort. (Hymenoptera : Cephidae).
Canad. J. Pl. Sci. 1960 : **40** : 29–46.
The hosts used were *Triticum aestivum* 'Red Bobs', 'Thatcher', 'Rescue' and 'PI17–0924' and *T. durum* 'Golden Ball' and 'Stewart'. Differences in rate of stem development largely determined the relative times, amounts and sites of oviposition under field conditions. Varietal differences in infestation were mainly due to disparities in growth rate. Resistance to oviposition was not a factor in sawfly resistance.

2556 Roberts, D. W. A.
Sawfly resistance in wheat. III. Changes in resistance during the development of the wheat plant.
Canad. J. Pl. Sci. 1960 : **40** : 7–20.

In an earlier paper [cf. XXV, 1909], it was shown that at least three types of resistance to sawfly (*Cephus cinctus*) may be recognized: resistance to (1) egg laying, (2) development of eggs and establishment of first-instar larvae and (3) development of the older larvae, the three types being respectively based on differences between varieties in (*a*) percentage of stems not infested, (*b*) percentage of infested stems with oviposition scars and (*c*) percentage of tunnelled stems not cut. A study was made of these three measures of resistance in (1) field experiments on Thatcher, Red Bobs, Rescue, H46146, H4191, Golden Ball and Melanopus with one date of sowing and on the first three of these wheats with several dates of sowing, and in (2) a greenhouse test of Rescue sown in January and exposed to sawfly infestation each week after the beginning of stem elongation. The results indicated that the pattern of resistance of a given variety depended not only on the environment but also on the stage of development of the plant at the time of infestation. The plants were usually most heavily infested for a part or all of the period from one week before the shot-blade stage to one week after the flowering stage. Rescue, H46146, H4191, Golden Ball and Melanopus lost the second type of resistance some time between the shot-blade stage and flowering. Regardless of the stage of development, (*b*) was always low in Thatcher and Red Bobs. The mortality of the older larvae increased in plants infested towards maturity. The time at which this increase began depended on the variety and ranged from just before the shot-blade stage to just after flowering.

2557 Nakagawa, M., Soga, Y., Watanabe, S., Gocho, H. & Nishio, K.
(Genetical studies on wheat mosaic virus. II. Genes controlling the manifestation of yellow mosaic virus in wheat).
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 118–20. [Japanese].

The genetics of reaction to the above virus was studied in the F_1–F_2 generations of crosses involving the resistant varieties Norin 45 [Ministry of Agriculture and Forestry 45], Norin 61* and Kinki 54, the partially resistant forms Shinchunaga [New Mid-long] and a selection of Norin 61 x Norin 43, and the susceptible varieties Tokai 55–A and Norin 43†, grown at the Tokai-Kinki experimental station. The three loci believed to control resistance to green mosaic [cf. XXIX, 3738] appear to determine resistance to yellow mosaic too. In as far as they affect yellow mosaic, $A>H>M$, $A>A_1>A_2$, $H>H_1>H_2$ and $M>M_1>M_2$; H and M determine susceptibility and A inhibits H. The genetic constitutions of the varieties studied are given as: Norin 45 and Kinki 54, Ahm; Shinchunaga A_1hM_1; Tokai 55–A, A_2hM_1; Norin 43, aHM; Norin 61, aH_1M_2; and Norin 61 x Norin 43, aH_2M_3.

2558 Zennyozi [Zennyoji], A.
[Cytogenetical studies on intergeneric hybrids between *Aegilops* and *Secale*. I. Chromosome pairing in the F_1 of *Ae. Crassa* (6*x*) x *S. cereale*].
Senshokutai (Chromosome)/Kromosomo 1959 : **40** : 1349–53. [Japanese].

A morphological and cytological description is given of the above hybrid. The modal meiotic configuration was $5_{II} + 18_I$. One trivalent was not infrequent and occasionally 2_{III} or 1_{IV} was observed. No grains were obtained by either open, self or back pollination.

BUCKWHEAT

2559 Lewicki, S., Ruszkowska, B. & Ruszkowski, M.
Studia nad gryką. Cz. VI. Zmienność plonowania w obrębieróżnych odmian i populacji gryki. **(Studies on buckwheat. VI. Variation in yield among different varieties and populations of buckwheat).**
Hodowla Roślin Aklimatyz. Nasiennictwo 1958 : **2** : 561–66.

In trials of four varieties and six local populations in Poland, positive correlations between stem length, number of branches, number of inflorescences and yield of seed were found. In some cases high yield was also correlated

* Appears as resistant in Table 1 but susceptible in Tables 2 and 3.
† The designations of the varieties studied vary in the different tables and the names given in the English summary are different again.

with high yield of straw and with high 1000-seed weight. The varieties Puławy and Bogatyr [Hero] were the most productive.

2560 Elagin, I. N.
(On the problem of the origin of buckwheat).
Bot. Ž. (Bot. J.), Moskva 1959 : **44** : 1177–81. [Russian].

The biological characteristics of the plant, its present distribution and linguistic evidence lead to the conclusion that *Fagopyrum esculentum* originated in the Himalayan region. Grounds are cited for believing that it was introduced into southern Russia early in the first century A.D.

2561 Ruszkowski, M.
Studia nad gryką. Cz. X. Porównanie wzrostu i rozwoju różnych odmian i populacji. (**Studies on buckwheat. X. Comparison of the growth and development of different varieties and populations**).
Hodowla Roślin Aklimatyz. Nasiennictwo 1959 : **3** : 209–16.

For four varieties and six local Polish populations grown in the years 1953, 1955 and 1956, data are given on the duration of, and growth in height during, each of five developmental phases from the formation of the inflorescence to maturity. Varietal differences in response to environment were detected. Varieties which were taller during flowering and maturity generally yielded more seed.

2562 Lewicki, S., Ruszkowska, B. & Szklarz, J.
Przyczyny złego owocowania gryki. Cz. I. Zagadnienie samopylności oraz kwiatów krótko- i długosłupkowych. (**Causes of poor fruit set in buckwheat. I. The problem of self pollination and of flowers with long and short pistils**).
Hodowla Roślin Aklimatyz. Nasiennictwo 1958 : **2** : 567–78.

In tests conducted in Lublin and Puławy, Poland, no difference in grain yield was found between types with long and types with short pistils. The grain set of single isolated plants was lower than that of plants isolated in groups of ten, which was in turn lower than that of open-pollinated plants. The grains were normal in each case, showing that the crop is a facultative self pollinator.

2563 Demianowiczowa, Z. & Ruszkowska, B.
Przyczyny złego owocowania gryki. Cz. II. Związek między oblatywaniem gryki przez pszczoły i plonowaniem tej rośliny. (**Causes of poor fruit set in buckwheat. II. The connexion between visits by bees to buckwheat and the crop yield**).
Hodowla Roślin Aklimatyz. Nasiennictwo 1958 : **2** : 579–86.

Observations in Puławy showed that 86·6% of the insects visiting buckwheat flowers were bees. The bees were most frequent at 7 and 9 a.m. and were absent in the afternoon. In different years a positive relation between numbers of bees and yield of grain was observed.

OATS

2564 Ştefan, I.
Experienţe cu soiuri şi linii de ovăz la Staţiunea Experimentală Agricolă Suceava. (**Experiments with varieties and lines of oats at the Suceava Agricultural Experimental Station**).
Stud. Cercet. şti., Biol. Şti. agric. Iaşi 1958 : **9** : 145–50.

Five varieties were tested; the highest yielding was the line Cenad 309.

2565 Petr, F. C.
Genotypic correlations, dominance and heritability of quantitative characters of oats.
Diss. Abstr. 1959 : **20** : LC Card Mic 59–2421 : p. 21. (Abst.).

Three methods of estimating degree of dominance were applied to F_1 data from 15 diallel crosses of Palestine, Andrew, Cody, Markton, Roxton and Victory. Two of the methods, constant parent regression (1) and potence ratio (2), provided estimates of the direction of dominance, while the components of variance method (3) gave an estimate of degree of dominance. Genotypic and environmental correlations between the six characters analysed, viz. height, panicle length, panicle number per plant, heading date, spikelet number per panicle and grain yield, were calculated from F_1 data. F_2 variances and covariances provided a basis for estimating heritability in the broad sense, as well as genotypic and phenotypic correlations between all combinations of the six attributes. Positive partial dominance values were obtained for height by all three methods. Panicle length

displayed partial dominance but the direction of dominance was not consistent. Heading date showed partial negative dominance, with good agreement between all three methods. Partial negative dominance was found for spikelets per panicle by (1) and partial positive dominance by (2). Overdominance was detected by all three methods for high number of panicles. Partial and complete dominance and overdominance were found respectively for yield by (3), (1) and (2). Heritability values for all crosses averaged 33, 53, 54, 61, 74 and 87% for panicle number, yield, panicle length, height, spikelet number per panicle and heading date, respectively. Genotypic correlations for panicle length with height and spikelet number were high, whereas low genotypic and high environmental correlations were detected between yield and panicle number. The genotypic correlation between panicle number and spikelet number per panicle was negative. Relatively high phenotypic correlations were obtained for height with panicle length, spikelet number and yield. Phenotypic and genotypic correlations were generally of the same magnitude but the latter were less consistent in some crosses. It is concluded that selection for yield and panicle number should be delayed until later generations while selection for the other four characters would be feasible in early generations.

2566 Zillinsky, F. J.
Monster mutant in oats.
Cereal News 1959 : **4** : No. 2 : 7–11.

Plants of the "monster" offtype, which appeared in the F_2 of Rodney x 624–4–1 and RL2278 x 624–4–1, are described. The parent 624–4–1 involved Clintland, Garry, Laurel and Klein 69B in its parentage. In the greenhouse, heading usually required 6–7 months, the panicles being up to 24 in. long and the plants up to 80 in. in height. The stem was almost normal in diameter at the base, increasing to about ½ in. at the uppermost internode. The type produced few if any tillers, and failed to head in the field. The pollen was normal in appearance but the anther walls were thick and burst with difficulty, a characteristic which may have contributed to the very high degree of sterility. The monster type was inherited as a complete recessive.

2567 **Tonka, new oat for the Southwest.**
Crops & Soils 1960 : **12** : No. 5 : p. 18.

This new spring oat variety has been approved for seed increase by the Oklahoma Agricultural Experiment Station. Said to have a higher yield and test weight than any spring oat variety now available in the state, it averaged 28·3 bushels per acre with a test weight of 30·8 pounds per bushel. Its straw strength is equal to that of Neosha and Cherokee and the grains are short, plump and bright yellow in colour. Tonka is resistant to Victoria blight and its early maturity enables it to escape rust damage and heat injury.

2568 Stuke, H.
Untersuchungen über den Rohfettgehalt des Hafers. (**Investigations on the crude fat content of oats**).
Z. Pflanzenz. 1959 : **42** : 147–98.

A quick method of estimating crude fat content was developed by which 140–200 samples could be dealt with daily. Glumes were removed by centrifuging before the estimation in order to eliminate the effect of differences in the fat content of the glumes. The husked material was ground up by an electric mill, extracted with benzine, centrifuged and the fat measured refractometrically. In this way the fat content of 396 oats in the Hohenthurm collection was determined; this collection included cultivated and wild forms, local races and land varieties. The crude fat content varied from 3·5 to 9·5% and the weight of crude fat per grain ranged between 0·45 to 2·45 mg. For the different countries average fat content increased in a southerly direction, the highest value being found in varieties from the Balkans. Wild forms had greater fat contents than cultivated forms. Possible correlations between fat content and various other characters were investigated; the length of time between appearance of the panicle and ripening was positively correlated with fat content in most cases and high protein content was combined with high fat content in some forms. From these results it appears that selection for fat content may only be carried out by means of a direct physicochemical determination of the fat present. Many of the varieties were not pure lines as regards fat content. Using the Castle-Knight formula it was found that six or seven genes probably control fat formation. Heritability for fat content in six crosses was between 82·8 and 97·4%. There was good agreement as regards fat content between élite lines and the A strains derived from them. Since fat content is not greatly modified by external conditions, it is possible to select for high fat content in the early generations of a cross. Already some success

has been attained in combining high fat content with high yield and other useful characters.

2569 Frey, K. J.
Yield components in oats. III. Their contribution to the variety x location interaction for grain yield.
Agron. J. 1959 : **51** : 744–46.

An example is worked out to show that a variety x environment interaction for yield is possible although the varieties x environment interaction is zero for the following three yield components: number of panicles per plant, number of seeds per panicle and weight per seed. Multiplicative interaction between the components may thus be a factor responsible for a variety x locality interaction variance for yield. In experiments conducted to test this hypothesis, it was found that the yield components had in most cases a lower variety x locality interaction variance than grain yield. In addition, for pairs of different centres, correlations between measurements of grain yield during 1957 were all nonsignificant, whereas those for each yield component were, with one exception, highly significant. It is suggested that "geometric epistasis", such as may occur in the combination of components determining grain yield, could be selected for and fixed in cereal varieties. Larger populations of segregates from crosses could be tested for yield components than for yield because the size of plot necessary would be smaller. Yield-component analyses could also be used in selecting parental combinations and predicting high-yielding segregates.

2570 Simons, M. D. & Michel, L. J.
Physiologic races of crown rust of oats identified in 1958.
Plant Dis. Reptr. 1959 : **43** : 1010–12.

Two new races have been discovered in 1958. Race 298 is the first race reported in N. America which can parasitize Landhafer but not Santa Fe. Trispernia is highly resistant to this race and Anthony and Bondvic intermediate in reaction.

Race 299 is pathogenic only on three of the standard differentials, Anthony, Victoria and Ukraine. The others show clear-cut resistance. The relative prevalence of race groups from uredial collections in the US was similar to that in 1957. Race 216 accounted for 54% of the total.

The pattern of racial prevalence from aecidial collections was different. Race 202 accounted for 40% of the total.

2571 Futrell, M. C., Carero, M. & Reyes, L.
Landhafer races of crown rust in oats in south Texas and northern Mexico in 1959.
Plant Dis. Reptr. 1959 : **43** : 1198–200.

The oat varieties Minhafer and Floriland, both susceptible to races of the 264 and 290 groups of crown rust, became infected in test plots, while the variety Suregrain, which is resistant to the 290 race group, remained uninfected. Prior to the 1958–59 season, these races had been present only in trace amounts in Texas and northern Mexico.

2572 Johnston, P. D. S.
Toxins associated with *Helminthosporium* blight of oats.
Diss. Abstr. 1959 : **20** : LC Card Mic 59–1535 : p. 43. (Abst.).

A toxin similar to victorin, which is obtainable *in vitro* from *Helminthosporium victoriae*, was extracted from Victorgrain infected by the fungus. The toxin was specific for Victorgrain and its toxicity was manifested by inhibition of root growth. "A total of 3,600 Victorgrain and 3,450 Arlington seedlings were screened with victorin in an attempt to obtain seedlings which would show intermediate reactions to Helminthosporium blight. Thirty-seven Victorgrain and 100 Arlington seedlings survived the treatment with an intermediate type of reaction. These selections showed varying reactions to crown rust and most of the selections were susceptible. Grain from the intermediate selections and from the next generation were treated further with victorin. Only two of the Arlington seedlings continued to show an intermediate reaction to victorin. It is possible that a complex locus controls reactions to crown rust and *H. victoriae*."

2573 Earhart, R. W.
The differentiation of pathogenic forms of *Eu-helminthosporium* species which attack oats.
Plant Dis. Reptr. 1959 : **43** : 1184–87.

The pathogenicity of 54 South Carolina *Eu-Helminthosporium* isolates was evaluated by studying the response of four oat varieties to mycelial macerates. These fell into two groups, the larger of which, comprising 94·4% of all the isolates, includes forms which incite Victoria blight. The smaller group contains forms which incite culm rot on Southland oats.

The epidemic of barley yellow dwarf on oats in 1959.
Plant Dis. Reptr. 1959 : Suppl. 262 : 316–84.

2574 *Murphy, H. C. Introduction.* (*p. 316*).
The following oat varieties were found to be moderately resistant under epiphytotic conditions in the north-central region of the USA: Albion, Fulghum, Newton, Putnam and Tonka (Early Clinton).

2575 *Petr, F. C. & Stevens, H. Barley yellow dwarf in Idaho in 1959.* (*p. 325*).
A tetraploid oat, CI7232, derived from the susceptible variety Black Mesdag, was found to be resistant to barley yellow dwarf virus. Progeny of an apparent cross between these showed segregation for resistance and susceptibility.

2576 *Jedlinski, H. & Brown, C. M. Barley yellow dwarf virus on oats in Illinois in 1959.* (*pp. 326–32*).
Yields, test weights and percentage barley yellow dwarf infection of 14 oat varieties are statistically analysed. Damage appears least severe in Clintland 60, Clinton, Clintland and Minton. Breeding for resistance is in progress, and data are given for several selections. Selections of Albion x Fayette gave substantially higher yields under epiphytotic conditions than either parent. Most resistant selections however are of poor agronomic type.

2577 *Caldwell, R. M., Schafer, J. F., Compton, L. E. & Patterson, F. L. Yellow dwarf infection on oats and wheat in Indiana in 1959.* (*p. 333*).
A comparison of the reactions of back-cross derivatives of Clintland and Putnam oat varieties showed that the latter were comparatively uninjured by barley yellow dwarf virus.

2578 *Browning, J. A., Wheat, J. G. & Frey, K. J. Yellow dwarf of oats in Iowa in 1959.* (*pp. 336–41*).
The varieties Putnam and Newton showed the highest resistance to barley yellow dwarf at three locations in Iowa.

2579 *Sill, W. H. (Jun.), King, C. L. & Heyne, E. G. Barley yellow dwarf in Kansas oats and barley in 1959.* (*pp. 342–45*).
As in Iowa, Putnam oats showed good resistance, also Kanota and Kanota derivatives, and Richland x Fulghum lines.

2580 *Kiesling, R. L. Yellow dwarf in Michigan in 1959.* (*p. 347*).
Garry oats showed less damage by barley yellow dwarf than other varieties, and this was reduced still further where a nitrogen top dressing was applied.

2581 *Rothman, P. G., Bowman, D. H. & Ivanoff, S. S. Occurrence of barley yellow dwarf on oats in Mississippi, 1959.* (*pp. 348–50*).
The following lines merit screening as possible sources of resistance: X5610 (unknown x Anderson selection CI4837) and 5X567 (Binder PI73231 x Hein II CI4837).

2582 *Sechler, D. T., Poehlman, J. M., Whitehead, M. D. & Calvert, O. H. The barley yellow dwarf virus - bacterial blight complex on oats in Missouri in 1959.* (*pp. 351–53*).
The damage done to oat varieties by the barley yellow dwarf - bacterial blight complex is statistically examined. Damage was least in Early Clinton (Okla. sel.) and CI7448 [(Victoria x Hajira-Banner) x (Victory x Hajira-Ajax)] x Mo. 0–205[2].

2583 *Rochow, W. F. & Jones, E. D. Barley yellow dwarf virus disease of oats in New York in 1959.* (*p. 360*).
For the second year, the progeny of some Craig x Alamo oat crosses showed resistance to natural infection by barley yellow dwarf virus.

2584 *Hebert, T. T., Kline, D. M. & Toler, R. W. Yellow dwarf of cereals in North Carolina in 1959.* (*pp. 361–63*).
The reaction of a large number of oat varieties is listed; Lee and Arlington are among those showing the least symptoms of disease, and also the lines Win. x (Cl[2]–SF) x Imp. Garry Md. 2950 and Arl. [Win. x (Cl[2]–SF)] Md. 310.
Barley varieties were inoculated with yellow dwarf virus, and Oma, Pace and Colonial 2 had some tolerance.

2585 *Bruehl, G. W. & Damsteegt, V. D. Observations on cereal yellow dwarf of oats in Washington in 1959.* (*pp. 369–70*).
The selection Saia of *Avena strigosa* is more tolerant than Albion. Over 400 strains have been judged superior to Albion in a preliminary screening.
Winter-oat trials have indicated that Ballard Selection and Fulwin are more resistant than Gray.

2586 *Shands, H. L. & Cruger, L. G. Yield of certain oat varieties under natural epidemic conditions of yellow dwarf (red leaf) virus in Wisconsin, 1959.* (*pp. 371–74*).

The following varieties have shown some degree of resistance: Ajax, Beedee, Fundy, Garry and Newton, and the selections CI7372 (Vickland[2] x Andrew - Landhafer Sel.), CI7107 (Ajax x Hawkeye-Victoria), CI1012, CI1050 and X481–3 (Arkansas 674 x CI4629).

RYE

2587 Anttinen, O.
Syysruislajikkeista Pohjois-Pohjanmaan rannikkoalueella. (**Winter-rye varieties in the coastal area of North-east Bothnia**).
Koetoiminta ja Käytäntö 1959 : **16** : 22–23.

Trials of a number of varieties have shown Onni [Fortune] to be the highest yielding, but its winter hardiness is surpassed by Ensi [First] and Toivo [Hope] which have average yields and by Greus which gives a lower yield. Strength of stalk is greatest in Visa [Curly], which also yields well, and in Sangaste and Pekka.

2588 Dumon, A. G.
Invloed van polygenen en oligogenen op de opbrengst van rogge (*Secale cereale* L.). [**The influence of polygenes and oligogenes on the yield of rye (*S. cereale* L.)**].
Agricultura, Louvain 1959 : **7** : 495–518.

In addition to previously reported results of inheritance studies on brittle straw, waxiness and anthocyanin pigmentation [XXIX, 3540] and on chlorophyll deficiencies [XXVII, 1505], the following observations are noted. The uneven appearance of some ears, due to the failure of some ovules to become fertilized or to ripen, is a recessive monogenic character. Long straw is dominant over short and is apparently determined by several genes; clones with very short straw have been isolated. Long spikes are dominant over short, the F_2 being variable. Two aberrant forms, zigzag stem and coalescent leaf sheaths, are both recessive, the latter lethal. Several genes control susceptibility to *Puccinia rubigo-vera* var. *secalis*, a recessive character.

Homozygosity for any of the major genes is not necessarily accompanied by a loss of vigour, the differences in yield between plants homozygous for any one character being attributed to the action of polygenes. Heterozygous *typica* plants ($WwC_1c_1C_2c_2$), obtained by crossing *virescens* (WW) with *subtypica* ($C_1C_1C_2C_2$), showed an increase in yield over both parents, an effect resulting primarily from the combination of $C_1 + C_2$ with W but also from the combining ability of polygenes. Within the *typica* group, four homozygous clones tested for combining ability have been used in the production of Celestijnerrogge [Celestine rye] [cf. XXIX, 3540]. The method used in clonal propagation is described.

2589 Walther, F.
Modellversuche zur Erzeugung synthetischer Heterosissorten beim Roggen. (**Model experiments for the production of synthetic heterotic varieties in rye**).
Z. Pflanzenz. 1959 : **42** : 11–24.

It was found that the polycross test is suitable for testing combining ability when rye synthetics are being developed. Also it was found convenient to sow the lines to be tested in rows, for in this way many lines may be tested in a small area. In the experiments described, 50 to 75% hybrid seed was obtained. Details are given of the method used for isolating and maintaining many inbred lines, the construction of the isolation tents being described.

2590 Nakajima, G.
(**Cytogenetical studies of intergeneric hybrids between *Haynaldia* and *Secale*. III. External characters and meiosis in the pollen mother cells of F_1 plants of *S. fragile* x *H. villosa***).
Idengaku Zasshi/Jap. J. Genet. 1959 : **34** : 373–80. [Japanese].

The hybrid is intermediate morphologically between the parents. At meiosis, up to 3 bivalents and occasionally trivalents were observed, but the modal configuration was 14_1. A few grains were obtained on selfing [cf. XXIV, 280].

2591 Håkansson, A.
Behaviour of different small accessory rye chromosomes at pollen mitosis.
Hereditas, Lund 1959 : **45** : 623–31.

Two plants of rye from Korea, each with $2n = 14 + 1$ small accessory, were examined. In one, the accessory divided at anaphase while in the other, lagging and nondisjunction were observed. Pollen mitosis was also investigated in plants of Östgöta containing two standard and 1–3 small accessories. In all of the five plants examined, both the standard and small

types underwent lagging and thus nondisjunction. It is suggested that, as in *Festuca pratensis* [cf. XXVI, 3404], the standards influence the small accessories so as to cause them to lag. It appears that small accessories may in most cases disturb the spindle to the same extent as the standard type. Except in one plant (045–9), division showed disturbances in chromatid behaviour of a c-mitotic type, irrespective of the number of small accessories. It is pointed out that in the plant in which such irregularities occurred in the presence of only one small accessory, the small arm of this chromosome was duplicated. In 045–9, usually having one or two small accessories of a new type in addition to the two standards, mitosis was however only slightly irregular. In this case the accessories appeared to have lost the capacity to disturb the spindle. Possibly in rye factors for spindle irregularity carried by standard accessories are situated in the short arm. The small accessories in 045–9 may consist mainly of part of the long arm.

2592 Sarvella, P.
The behavior of accessory chromosomes in tetraploid rye.
Hereditas, Lund 1959 : **45** : 505–63.

Tetraploids of Transbaikal rye with 2, 4, 5, 6, 7 and 8 standard accessories were studied with respect to the behaviour of these chromosomes at meiosis and first pollen mitosis and to the transmission of accessories to the progenies of intercrosses between plants with the same number of accessories. The $4x$ population contained (1) a greater proportion of plants with accessories and (2) individuals with higher numbers of accessories than the $2x$ population of the same variety. It was therefore more tolerant of the presence of accessories. Number of standard accessories among $4x$ individuals ranged from 1 to 12, the latter number being found in a single plant. Some plants also contained isochromosomal accessories. As indicated by root-tip counts of the intercross progenies, the tetraploids did not show two features typical of diploid rye: a marked increase in average number of accessories and accumulation of accessories in even numbers [cf. XXVI, 22]. In the tetraploids meiotic elimination was therefore more important than numerical increase through nondisjunction and inclusion in the generative nucleus. In addition, the $4x$ population contained more deviating types of accessories. Frequency of pairing of accessories in $4x$ plants usually increased as the number of such chromosomes increased. Addition of a small isochromosome to the complement of $2n + 2$ standards reduced pairing between the standards at metaphase I; no definite conclusions were reached as to the nature of this effect. Accessories which lagged at anaphase I divided and were usually included in the telophase nuclei. Many anaphase II laggards were lost as micronuclei and a considerable amount of elimination of accessories occurred. Data on metaphase and anaphase of the first pollen division do not provide a valid basis for predicting frequency of transmission of accessories to progenies in either tetraploids or diploids. The nondisjunction mechanism apparently operated normally in the $4x$ plants. Discrepancies between diploids and tetraploids as regards frequency of transmission may be explained on the basis of either exclusion of accessories showing nondisjunction from the generative nucleus or selection against gametes with many accessories. Some types of abnormalities in meiosis and pollen mitosis in both tetraploids and diploids seem to be related to the presence of accessories. The occurrence of three or more accessories in a pollen grain has been observed to cause abnormalities associated with malfunctioning of the spindle of the first pollen division. At meiosis, tripolar spindles may also be ascribed to the action of accessories. The percentage of abnormal cells in the first divisions of the pollen increased in direct proportion to the number of accessories. This relationship did not appear to be influenced by chromosome number.

2593 **Svalöf Fourex—a new rye for California.**
Crops & Soils 1960 : **12** : No. 4 : p. 18.

Fourex, a tetraploid spring rye introduced from Sweden [cf. XXIX, 165], has given good forage yields when grown as a winter crop in mild-winter regions. It has stiff straw, high dry matter content and is not seriously damaged by dwarf yellow virus or common root rots. In California the variety has proved more fertile than was expected from the results of Swedish tests.

2594 Ruebenbauer, T. & Biskupski, A.
Próba zastosowania metody sedymentacyjnej w celu określenia wartości wypiekowej żyta. (**An attempt to apply the sedimentation method to the determination of baking quality in rye**).
Hodowla Roślin Aklimatyz. Nasiennictwo 1958 : **2** : 459–78.

Data are given on the protein content, bread

volume, starch viscosity and sedimentation values for 14 varieties grown in 19 localities in Poland and a method of quality evaluation which can be used both for whole-meal flour and for flour of 70% extraction is described.

2595 Ozaist, B.
Wstępne obserwacje nad wyleganiem żyta tetraploidalnego i diploidalnego. (**Preliminary observations on lodging in tetraploid and diploid rye**).
Hodowla Roślin Aklimatyz. Nasiennictwo 1959 : **3** : 249–75.

The tetraploid rye studied, a derivative of Tetra-Roggen [Tetra rye], had stiffer straw and was more resistant to lodging than the diploid Ludowe [Popular]. Lodging resistance was correlated with: (1) a smaller proportion of parenchyma in the sclerenchymatous ring of the second internode below the ear; (2) greater thickness of the stem tissues and superior cell size; and (3) a greater amount of sclerenchyma in the lower internodes. The degree of lignification did not appear to be of importance under Polish conditions.

2596 Skripčinskij, V. V.
(**Biological characteristics and prospects of the utilization of spring and winter forms of perennial rye**).
Dokl. Akad. Nauk SSSR (Proc. Acad. Sci. USSR) 1959 : **129** : 691–94. [Russian].

A spring form of perennial rye has been selected from a hybrid population of Deržavin's perennial rye. It is earlier and more productive of grain than winter rye when sown in the autumn and its grain is of superior quality. The spring form shows improved resistance to ergot.

2597 Morey, D. D.
Reaction of rye varieties to leaf rust.
Robigo, Castelar 1959 : No. 9 : 2–4; also in Spanish, 4–6. (Mimeographed).

Tables showing the percentage of resistant plants are given for 75 introduced varieties and 31 American varieties tested against a local population of *Puccinia recondita* at Tifton, Ga., in 1959.

MAIZE

2598 Kalinin, M. S.
(**The best varieties and hybrids for different zones**).
Kukuruza (Maize) 1959 : No. 3 : 32–34. [Russian].

The results of testing maize varieties and hybrids adapted to the different climates of the USSR are reported. Worth mention are the trials in the Nonchernozem Belt, where the topcross Bukovina 3 yielded more green and dry matter than all other varieties, including the late Sterling and the early Voronež 80.

2599 Grădinaru, N. & Cristea, M.
Studiul soiurilor, populațiilor și hibrizilor între soiuri de porumb potriviți pentru nord-vestul Moldovei. (**The study of varieties, populations and intervarietal hybrids of maize suitable for north-west Moldavia**).
Stud. Cercet. ști., Biol. Ști. agric. Iași 1958 : **9** : 125–38.

Trials of the above categories of maize at the Suceava research station during 1953–57 are reported. Among the higher yielding forms were the intervarietal hybrids Timpuriu de Moara Domnească [Moara Domnească Early] x Hîngănesc [maize from Hîngu] and Hîngănesc x Arieșan Timpuriu [Early maize from Arieș].

2600 Rakover, Y.
(**Irrigated maize in 1958**).
Sadeh (Field)/Hassadeh 1959 : **39** : 740–43. [Hebrew].

Maize trials under irrigated conditions are reported. Some new varieties such as NY182 have been introduced. NY22 has yielded 1162 kg./dunam*.

2601 **Trial report of the West African Maize Research Unit, Moor Plantation, Ibadan 1957** (1959) : Pp. 40.

A report is given on the results of trials of African and New World entries during 1957 [cf 334].

2602 Telkiev, G. & Tomov, N.
(**The sowing of maize in south-eastern Bulgaria**).
Kooper. Zemed. (Cooper. Fmg.), Sofija 1959 : No. 3 : 14–15. [Bulgarian].

Mention is made of testing varieties and hybrids at Poljanovgrad. The Soviet double cross VIR 42 [Institute of Plant Industry 42] was superior in yield, drought resistance and earliness to all hybrids tested, while some American double crosses such as Ohio C92 and Nebraska 301 produced satisfactory yields under irrigation. Most American double crosses yielded less than the Bulgarian intervarietal hybrid A26 x Čirpan 96 under rainfed conditions. The crosses VIR 42 x Čirpan 96 and VIR 42 x

* 1 dunam = 0·23 of an acre.

Čirpan 87 outyielded the local standard variety and the hybrid A26 x Čirpan 96 by considerable margins.

2603 Mureşan, T. & Dan, A.
Comportarea hibrizilor şi soiurilor de porumb în condiţiile pedoclimatice din R.P.R. (**The behaviour of maize hybrids and varieties under the pedoclimatic conditions of the Rumanian People's Republic**).
Probl. Agric., Bucureşti 1959 : **11** : No. 3 : 50–68.

Following an extensive series of trials throughout Rumania, recommendations are made of the best double hybrids, intervarietal hybrids and varieties for the 14 maize-growing zones of Rumania. The double hybrids are markedly superior to the other categories in yield.

2604 Oprişor, N. *et al.*
Comportarea cîtorva hibrizi de porumb în condiţiile de la Ezăreni-Iaşi in anii 1956–1958. (**The behaviour of some maize hybrids under the conditions of Ezăreni-Iaşi in the years 1956-58**).
Lucrăr. şti. Inst. agron. Ion Ionescu de la Brad Iaşi 1959 : 115–22.

Trials of intervarietal hybrids, double hybrids and hybrids between double hybrids and the variety Portocaliu de Ezăreni [Ezăreni Orange] are reported, data being provided on yield, maturation period, grain characters and the chemical composition of the grain. The highest yield was given by the double hybrid Pioneer 329 though this is too late to escape early autumn frosts.

Studier av hybridmajs för ensilage. (**Studies of hybrid maize for silage**).
Växtodling 1959 : No. 11 : Pp. 148.

2605 *Gelin, O. E. V. & Gustafsson, H. Odlingstekniska försök med fodermajs i södra Sverige.* (*Experiments in cultivation technique with fodder maize in southern Sweden*). (*pp. 10–25*).

In addition to results of experiments on seed rate, sowing time, weed control, fertilizer treatment and harvesting time, data from yield trials of early, medium-early and medium-late varieties tested during 1950–54 are presented. The early varieties were lower than the others in dry-matter yield, but no differences in dry-matter composition were found among the three maturity classes.

2606 *Åberg, E. & Larsson, R. Odlingstekniska försök med ensilagemajs i mellersta Sverige.* (*Experiments in cultivation technique with maize for silage in central Sweden*). (*pp. 26–43*).

Concerned chiefly with investigations on fertilizing, seed rate and sowing and harvesting dates, this paper also includes the results of varietal trials conducted in 1953–54. The early variety Eagle Hill yielded less than medium early or medium late varieties, but gave a higher proportion of ears.

2607 *Eliasson, S. Preliminära resultat av Statens Jordbruksförsöks försök med hybridmajs till grönfoder.* (*Preliminary results of the National Agricultural Research Station's trials of hybrid maize for green fodder*). (*pp. 54–57*).

Hybrid maize gave higher yields than other crops tested with the exception of mangels. In preliminary tests of six varieties in 1955–57, Prior gave the highest average yields of dry matter and protein.

2608 *Åkerberg, E. & Torssell, B. Förädlingsmetodiska undersökningar med ensilagemajs.* (*Investigations on breeding methods for silage maize*). (*pp. 77–107*).

Seventy American, Netherlands and Swiss inbreds studied at Ultuna and Weibullsholm in 1952–54 showed marked variation in vigour and earliness, particularly the Wisconsin lines, among which flint inbreds had higher vigour and were about two weeks earlier in development than dents. Among Netherlands lines, some were very early and good in ear production while others were high in yield of green matter. Swiss lines equalled the best American lines in vigour but were later in development. Of the 30 hybrids studied, the European ones were generally more vigorous and germinated and grew better in cold spring weather than the American; the highest yields were given by Swiss hybrids and the Netherlands hybrid Prior, all equalling Wis.240 in earliness. A negative correlation was found between yield of green matter and earliness, the higher yields of the late hybrids being chiefly due to development of the stems. Early hybrids were slightly higher in dry-matter content and differed little from the late in fibre content. Of a number of hybrids produced at Ultuna, few surpassed Wis.240, the greatest vigour, height and green-matter yield being found in crosses between Swiss and American inbreds. The bearing of the above results on problems of hybrid-maize breeding and production in Sweden is discussed.

2609 *Andersson, G. & Lööf, B. Försöks- och förädlingsarbeten med ensilagemajs vid Sveriges Utsädesförening.* (*Testing and breeding of silage maize at the Swedish Seed Association*). (*pp. 108–25*).

Data on earliness, yield of green matter, dry-matter content, dry-matter yield, contents of protein, ethereal extract, N-free extract, crude fibre and ash, yields of protein and crude fibre and fodder value are given for numerous varieties tested in Sweden during 1948–57. It is noted that lines from Eagle Hill are being subjected to further inbreeding and hybridization; Swiss inbred lines also show promise and have given good single hybrids with American lines. The difficulties of developing material early enough to allow seed production in Sweden and at the same time productive enough to be useful for ensilage are discussed.

2610 *Åberg, E. Studier rörande köldtolerans hos majs.* (*Studies of cold tolerance in maize*). (*pp. 126–48*).

A report of this work in English has already been summarized [XXIX, 3834].

2611 Rassel, A.
La sélection du maïs. (**Maize breeding**).
Bull. agric. Congo belge 1959 : **50** : 1503–26.

A general review is given of the breeding methods used in maize improvement.

2612 Gwynn, G. R.
Relation between means and components of genotypic variance in biparental progenies of a variety of maize.
Diss. Abstr. 1959 : **20** : LC Card Mic 59–2416 : p. 37. (Abst.).

"By assuming absence of epistasis estimates of additive genetic variance and dominance variance may be obtained from the analysis of variance of biparental progenies.

"In this study a sample of ten S_0 plants and their S_1 families was chosen at random from an improved strain of the corn variety Krug and within each S_1 family biparental progenies were made up. The testcross and S_1 progeny performance of each of the parent S_0s was correlated with the estimates of additive genetic variance and dominance variance. Observed correlations were low in most cases. Adjusted correlations indicated that where additive genetic variance was highly correlated with S_1 or testcross performance then the corresponding dominance correlations were low and vice versa. In general positive correlations were indicated between additive genetic variance and S_1 progeny yield and between dominance variance and testcross yields.

"Tests of significance revealed significant amounts of additive genetic variance for each character measured in almost every S_1 family. The estimates obtained for dominance variance were rather low. There was a considerable range in additive genetic variance among the ten families. Estimates of heritability in the narrow sense were computed and they reflected the range in estimates of additive genetic variance.

"Estimates of interaction of average gene effect with environments experienced in the two years of test indicated some cases of significant interaction in all characters measured except kernel row number. The same general results were obtained in estimating the interaction of dominance deviations with environments.

"Ratios of dominance variance to additive genetic variance were computed in an effort to get some idea of the type of gene action involved. Some of the values obtained fell in the range indicative of overdominance but it must be pointed out that such values may have been due partly, at least, to the sampling variation obviously present."

2613 Graner, E. A.
Provável posição do gen *Y7* no cromossomo 7 do milho. (**The probable position of gene *Y7* in chromosome 7 of maize**).
An. Esc. Agric. Queiroz 1957–58 : **14-15** : 81–89.

Crosses involving lines carrying genes *y7*, *gl1* and *ij* suggest that these three genes are linked in the order quoted and are on chromosome 7. Gene *y7* is 10 units from *gl1* and *gl1* is 16 units from *ij*.

2614 Bolhuis, G. G.
Hybrid seed maize. Cultivation in the tropics and sub-tropics.
World Crops 1960 : **12** : 29–30.

The writer gives various reasons for his view that hybrid maize seed imported from the USA should not be used in tropical and subtropical regions. Hybrid maize for such regions should be developed from pure lines, bred locally, and should fulfil the following requirements. (1) The length of its growing period should be the same as that of the native varieties, or only slightly greater. (2) The hybrids should outyield the native varieties, without much more fertilizer or care. (3) Hybrids should be of the pearl type. (4) The cost of the seed to the farmer should not be much higher than that of

ordinary seed. In many tropical and subtropical areas, however, it may be preferable at present to apply the mass, ear-per-row or recurrent-selection procedures.

2615 Bleier, H.
Entwicklung und Stand der deutschen Hybridmaiszüchtung. (The development and position of German hybrid maize breeding).
Saatgutwirtschaft 1960 : **12** : 9–10.
The development, aims and achievements of hybrid maize breeding in Germany are briefly outlined.

2616 Le sementi di mais per il 1960. **(Maize seed for 1960).**
Maydica, Bergamo 1960 : **5** : No. 1 : 27–29.
A list is given of the hybrids in the various maturity classes recommended for sowing in Italy.

2617 Belaš, T. I.
(For a high maize yield in the central Nonchernozem Belt).
Kukuruza (Maize) 1959 : No. 3 38–39.: [Russian].
Breeding work in Moscow is discussed and recent intervarietal hybrids and hybrid populations which yield 10–20% more forage than Sterling are listed. Hybrid populations such as Moscow 3 were obtained by sowing mechanical mixtures of a dozen varieties with different growth periods. Many inbred lines, some of which are resistant to *Oscinella*, have been developed and the work on testing their combining ability has begun.

2618 Musijko, A. S. & Ključko, P. F.
(New promising maize hybrids).
Dokl. Vsesojuzn. Akad. sel'skohozjajstv. Nauk Lenin. (Proc. All-Un. Lenin Acad. agric. Sci.) 1959 : No. 3 : 6–9. [Russian].
New hybrids earlier and more productive of grain than the double cross VIR42 [Institute of Plant Industry 42] are reported from the Lysenko Institute of Breeding and Genetics. Odessa 13 and Odessa 17 were obtained from pollination of Odessa Gruševka and Voronež 76 respectively by the single cross Slava [Glory]; Odessa 19 resulted from Voronež 76 x line 44. In addition to these, mention is made of the hybrids Slava ♀ x Odessa Gruševka and Slava ♀ x Voronež 76 where the female component had sterile pollen. The last two hybrids were more productive than Odessa 13 and Odessa 17 and their growth periods were only 1–2 days longer.

2619 Crane, P. L. & Alvey, D. D.
Performance of commercial dent corn hybrids in Indiana, 1955-1959.
Res. Bull. Purdue Univ. 1959 : No. 689 : Pp. 24.
Information is given on the performance of a large number of commercially available hybrids.

2620 **New corn hybrid released in Wisconsin.**
Crops & Soils 1960 : **12** : No. 5 : p. 19.
A new high-yielding maize hybrid designated W417 is announced by the Wisconsin Agricultural Experiment Station. The ears are compact, of medium shape and size, and easily husked.

2621 Todorov, P.
(Results of comparative trials of intervarietal maize hybrids).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1959 : **5** : 173–83. [Bulgarian].
These trials were carried out in Sofia. Nine of the 12 hybrids studied either resembled the earlier parent in their vegetative period or they were intermediate between the parents. Five of the hybrids produced more well-developed ears than the parent varieties and the other seven resembled the better parent in this respect; seven hybrids had longer ears than both parents. The number of rows in the ear resembled that of the mother plant in all the hybrids. Nine hybrids yielded between 2·92 and 22·27% more grain than the corresponding better parent. The greatest increase in yield was obtained from VIR 42 x Čirpan 96. Forty of the 49 hybrids involved in another test outyielded the local yellow maize. Hybrids are recommended for cultivation in the Sofia district.

2622 Fleming, A. A., Kozelnicky, G. M. & Browne, E. B.
Cytoplasmic effects on agronomic characters in a double-cross maize hybrid.
Agron. J. 1960 : **52** : 112–15.
The double cross studied was the yellow hybrid GAC0211, four lots of seed being produced in such a way that a different inbred furnished the cytoplasm for each lot. Significant effects which, pending further investigations are interpreted as cytoplasmic rather than maternal,

were obtained with respect to silking, ear height, plant height, percentage of erect plants at harvest, yield and budworm damage. Differences in the performance of the inbreds *per se* did not necessarily correspond to differences in the effect of their cytoplasm in hybrid combinations. Most of the latter differences were, however, in the direction expected on the basis of inbred performance *per se*. A differential cytoplasmic effect on one character did not necessarily mean that a differential effect was obtained for the same two sources of cytoplasm as regards other agronomic characters. Furthermore, it was found that a significant cytoplasmic effect detected in one year might not occur in another year under different environmental conditions. The results suggest that it may be worth while to plan crosses in certain back-cross programmes so that the recovered lines will have the same cytoplasm as the original lines, unless a different cytoplasm is specifically desired. In developing a commercial double cross, an attempt to bring together the cytoplasm and genotype giving the most efficient production in the final combination also appears desirable.

2623 Săulescu, N. & Ionescu, M.
Cercetări asupra productivităţii, maturităţii şi calităţii porumbului dublu hibrid. (**Investigations on the productivity, maturity and quality of double hybrids of maize**).
Probl. Agric., Bucureşti 1958 : **10** : No. 10 : 20–31.

Information is provided on the yield, maturation period and chemical composition of the grain of double hybrids, mainly introduced from the USA or USSR. The best double hybrids greatly outyielded Rumanian intervarietal hybrids. Their flour was, in general, satisfactory for preparing *mămăligă*, a dish similar to the Italian *polenta*.

2624 Ionescu, M., Ivănescu, M. & Ferando, M.
Caracterele biochimice ale hibrizilor dubli de porumb cultivaţi la Fundulea în 1957. (**Biochemical characters of the double hybrids of maize grown at Fundulea in 1957**).
Probl. Agric., Bucureşti 1958 : **11** : No. 6 : 13–22.

A large series of hybrids grown at the above station was analysed for content of starch, fat, protein and carotene. Information is also provided on vegetative period and 1000-grain and hectolitre weights. While the hybrids were frequently superior to the local variety ICAR54 in protein and fat contents, they were usually inferior in starch content.

2625 Kiesselbach, T. A.
Performance of advanced generation corn hybrids.
Agron. J. 1960 : **52** : 29–32.

In the absence of selection, advanced generation seed reaches minimum productivity in the F_2 when sibbing occurs; in the case of selfing, productivity continues to decrease until complete homozygosity is reached.

2626 Hulpoi, N., Negomireanu, V. & Sarca, Tr.
Experienţe cu porumb dublu hibrid în condiţii de irigaţie. (**Experiments with double-hybrid maize under irrigated conditions**).
Probl. Agric., Bucureşti 1959 : **11** : No. 4 : 30–43.

Information is provided on the response to irrigation of double hybrids at Fundulea-Bucureşti in 1957–58. The best responses were obtained from Iowa 4316, Pioneer 301 and 383 and Warwick 600.

2627 Ionescu-Şişeşti, Vl. & Jovmir, Gh.
Experienţe cu porumbul dublu hibrid în condiţii de irigare pe solul brun-roşcat de pădure. (**Experiments with double-hybrid maize under irrigated conditions on reddish-brown forest soil**).
Probl. Agric., Bucureşti 1959 : **11** : No. 5 : 39–48.

Trials of double hybrids, with and without irrigation, at the Balotesti field station of the Săftica research institute are reported. Under both sets of conditions, Pioneer 329 performed best.

2628 Mostovoj, K.
Trvání heterózního efektu u kukuřice. (**The duration of the heterotic effect in maize**).
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1959 : **32** : 1651–62.

At Lednice in Moravia, the performance of some F_1 hybrids was compared with that of the F_2 and F_3 generations and it was found that these later progenies were less productive than the corresponding F_1 hybrids. In some cases the

decrease in grain yield was very slight. Some changes in other quantitative characters were also observed in the later generations.

2629 Gologan, I., Cojeneanu, N. & Scumpu, N.
Unele observaţii cu privire la scăderea vigorii hibride in F_2 la hibrizii de porumb. (**Some observations on the decline in hybrid vigour in the F_2 of maize hybrids**).
Stud. Cercet. şti., Biol. Şti. agric. Iaşi 1957 : **8** : 245–52.

The F_2 of the intervarietal hybrid Galben timpuriu [Early Yellow] x Portocaliu de Tg. Frumos [Tîrgu Frumos Orange] yielded 92·5% in comparison with the F_1; in the case of the much higher-yielding double interline hybrid Pionier 352, the F_2 yield was 69·4% of the F_1.

2630 Pamfil, C.
Influenţa diferitelor agrofonduri asupra heterozisului la hibrizii între soiuri de porumb în generaţia 1-a. (**The influence of different agronomic conditions on heterosis in 1st generation intervarietal hybrids of maize**).
Lucrăr. şti. Inst. agron. Petru Groza Cluj 1958 : **14** : 137–61.

Differences in the manifestation of heterosis in respect of yield and earliness when F_1 intervarietal hybrids of Galben timpuriu [Early yellow] x Arieşan [maize from Arieş] and Galben timpuriu x Portocaliu de Tg. Frumos [Tîrgu Frumos Orange] were subjected to various fertilizer treatments are reported.

2631 Pamfil, C.
Contribuţii la studiul manifestării heterozisului în generaţiile înaintate la hibrizii între soiuri de porumb. (**Contributions to the study of the manifestation of heterosis in advanced generations of intervarietal hybrids of maize**).
Lucrăr. şti. Inst. agron. Petru Groza Cluj 1959 : **15** : 87–100.

It is claimed that heterosis in the intervarietal hybrids Galben timpuriu [Early Yellow] x Portocaliu de Tg. Frumos [Tîrgu Frumos Orange] and Galben timpuriu x Arieşan [maize from Arieş] can be conserved in the F_2 and F_3 if the hybrid progenies are trained on richly fertilized plots.

2632 Cornu, A.
Répartition de l'effet d'hétérosis sur dix des principales caractéristiques anatomiques, physiologiques ou culturales du maïs. (**The distribution of the effect of heterosis on ten of the principal anatomical, physiological or cultural characteristics of maize**).
Bull. Soc. Sci. nat. phys. Maroc 1957 : **37** : 89–103.

Using two American dent lines and twelve Moroccan flint lines, 34 F_1 hybrids were obtained of which 25 were derived from flint x flint crossings and 9 from dent x flint. The characteristics examined were: length of time to flowering, height from soil level to node bearing the highest ear, total height from soil level to the base of the male panicle, relative ear height as a proportion of total height, total number of leaves produced, average ear length, the number of kernel rows per ear, the number of ears per plant, 100-grain weight and total yield.
Manifestations of heterosis were most pronounced in the following: length of time to flowering, height of ear, total height, ear length and total yield. Heterotic effects were negative in the case of the length of time to flowering and in the total number of leaves produced, but positive in the case of the other eight characters. Hybrid vigour was greater in the flint x flint progenies than in dent x flint.

2633 Zonjić, I. & Marić, M.
[**Studying the hybridizing (combining) ability of some inbred lines of our own maize**].
Zborn. Rad. poljoprivred. Fak./Rev. Res. Wk. Fac. Agric., Beograd 1958 : **6** : No. 1 : 173–86. [Serbian].

Three different testers were used. The highest yields were obtained when the S_5, S_6 and S_7 lines were crossed with the open-pollinated dent variety Šidski Zuban [Šid Dent]. Many of the lines differed in yield according to the tester used. It is thought that the tester WF9, an American inbred line, has a low additive or high dominance effect; the lowest yields were obtained from crosses with this line. Crosses between lines of white dent and white flint varieties were particularly productive.

2634 Mumm, W. J.
Can maize be harvested like wheat?
World Fmg., Kansas City 1960 : **2** : No. 2 : 6–7.

A multiple-eared type of maize, which may be grown and combine-harvested by methods

similar to those used for small grain crops, has been developed by crossing maize and teosinte and back crossing to maize. Only 5 ft. tall, the plants each produce 5–6 stalks, with 6–10 ears on every stalk. The faster-drying ears are 6–8 in. long with cobs the size of a lead pencil, and are distributed evenly on the stalk. The stalks are hard and rigid and therefore do not lodge when crowded. In addition, the new type is heat and drought resistant and its grain has a higher protein content. A limited quantity of seed will be marketed in 1961.

2635 Pamfil, C.
Influenţa educării asupra unor soiuri de porumb (Galben timpuriu, Arieşan şi Portocaliu de Tg. Frumos). [**The influence of training on some maize varieties (Early Yellow, maize from Arieş and Tîrgu Frumos Orange)**].
Lucrăr. şti. Inst. agron. Petru Groza Cluj 1959 : **15** : 101–10.
Cumulative increases in yield are reported from growing the above varieties for several years on richly manured soil.

2636 Zonjić, I.
[**Biological and economic characteristics of the white maize varieties (populations) of Serbia**].
Zborn. Rad. poljoprivred. Fak./Rev. Res. Wk. Fac. Agric., Beograd 1957 : **5** : No. 2 : 3–40. [Serbian].
This paper includes information on the history of the introduction of maize into Serbia, the varieties grown and the duration of the growing period and other developmental stages of these varieties.

2637 Tomozei, I.
Rezultatele culturilor comparative cu populaţii de porumb alb din Moldova. (**The results of comparative trials of white maize populations from Moldavia**).
Lucrăr. şti. Inst. agron. Ion Ionescu de la Brad Iaşi 1959 : 163–70.
In a trial of four local white-maize populations, Alb mare [Large White] outyielded the intervarietal hybrid Galben timpuriu [Early Yellow] x Portocaliu de Tg. Frumos [Tîrgu Frumos Orange]. The principal defect of the white maizes is their deficiency in carotene.

2638 Coe, E. H. (Jun.).
A line of maize with high haploid frequency.
Amer. Nat. 1959 : **93** : 381–82.
At the University of Missouri, inbred stock 6 has shown 343 haploids in 10,616 observed plants. These haploids are always small with narrow erect leaves and the tassels and ears are usually completely sterile. There is evidence that the high frequency of haploids is mainly attributable to the pollen of stock 6; it is heritable and can be transmitted into other genetic backgrounds. In a cross between stock 6 and another inbred, there was a certain degree of dominance of factors conferring a low frequency of haploid induction.

2639 Kubok, I.
Badania nad stożkami wzrostu u kukurydzy jako morfologicznymi wskaźnikami oceny długości okresu wegetacji. (**Studies on growing points in maize as morphological indices for the evaluation of the length of the vegetative period**).
Hodowla Roślin Aklimatyz. Nasiennictwo 1959 : **3** : 69–103.
Short photoperiods induced earlier differentiation of the growing point than long, an effect which was generally less marked in early than in late varieties; some of the latter, e.g. Przebędowska Biała [Przebędowo White] were however almost day neutral. Under natural day lengths, differentiation occurred earlier in varieties with a short vegetative period than in those with a long. The onset of photoperiodic sensitivity was found to coincide with the occurrence of differentiation. These studies, which were carried out on varieties of dent, sweet and pop corn, indicate that the state of the growing point several days after germination may be used as an index of the earliness of the variety.

2640 I'só, I.
Adatok a kukorica fattyasodásához és fattyazásához. (**Data on tillering and tiller removal in maize**).
Magyar tud. Akad. Agrártud. Oszt. Közl. 1959 : **15** : 387–412.
Tables showing the degree of tillering occurring in a number of Hungarian varieties and hybrids are given and the effects of external factors and of removal of tillers are considered for a few varieties.

2641 Gutierrez, M. G. & Sprague, G. F.
Randomness of mating in isolated polycross plantings of maize.
Genetics 1959 : **44** : 1075–82.
Randomness of mating was studied at the Iowa

Agricultural Experiment Station, Ames, in polycross plantings of stocks which were each homozygous for a different simply inherited recessive character affecting the seed or young seedling. The seed traits used were yellow scutellum (*sy*), waxy endosperm combined with an unidentified semisugary type (*wx* su_{205}), sugary (su_1), brittle (bt_1) and shrunken (sh_1), while the seedling markers were virescent (v_{17}), liguleless (lg_2), white leaf tip (*wt*) and stripe (*str*). Randomness of mating was not realized under the prevailing conditions of open pollination in the experiment, marked tendencies being detected towards an excess of selfing or sibbing and towards less cross pollination than expected between stocks similar in dates of pollen shedding and silking. Number of plants shedding pollen, length of pollen-shedding period and plant height were significantly associated with percentage of male functioning. Dates of pollen shedding and silking and weight of pollen shed were not however related to the over-all performance of the stocks as ♂ parents. Two other factors, position in the polycross block and selective fertilization, did not play an important part in the departure from random mating. It would appear that the same factors operating in the present study would have persisted to a greater or lesser extent through at least the next cycle of open pollination. The possible bearing of these results upon procedures used in the production of synthetics and recurrent selection and upon equilibrium values in open-pollinated varieties is discussed.

2642 Ščedrina, R. N.
(Studying the fertilization process in maize, employing different methods of pollination).
Agrobiologija (Agrobiology) 1959 : No. 2 : 193–97. [Russian].

Cytoembryological observations at the Genetics Institute of the USSR Academy of Sciences showed that self pollination and restricted pollination reduced the metabolic exchange between the pollen and pistil and slowed down fertilization generally. A noticeable improvement in metabolic processes and fertilization was obtained by supplementary pollination in selfs and plants subjected to restricted pollination with pollen of other plants of the maternal variety or of other varieties. Metabolic exchanges and fertilization were promoted still more by using pollen mixtures comprising the pollen of two other varieties or a large amount of pollen from different plants belonging to the same variety as the maternal parent.

2643 Díaz Robles, J. C.
Estudio del alfa-beta dichloro-isobutirato de sodio como gametocida del maíz.
(Study of sodium α,β-dichloroisobutyrate as a gametocide for maize).
Rev. Assoc. Ind. agron., Montevideo 1959 : **30** : No. 105 : 34–37.

At concentrations up to 1% the above compound was without apparent effect. At 1–1·5%, white spots appeared on the leaves; at 2%, larger spots were produced and growth was slightly reduced; at 2·5–3%, growth ceased, tassels and ears showed abnormal development and pollen sterility was about 20–30%; and at 4% and above all plants died.

2644 Mostovoj, K.
O labilnosti pylové sterility u kukuřice.
(The lability of pollen sterility in maize).
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1959 : **32** : 1625–36.

Crosses were made between stable inbred lines in order to obtain forms with sterile pollen. In some of the progenies, the pollen sterility was a stable character unaffected by changes in the environment. Other plants showed varying degrees of sterility; some had pollen-sterile flowers on the main stem and partially fertile flowers on the lateral stems. Plants with unstable pollen sterility reacted in various ways to temperature changes; also, after photoperiodic induction, more partially fertile plants were obtained. Variation in pollen sterility was more frequent amongst plants with the Moldavian type of sterility than amongst those with the Texan type. It is emphasized that in selecting for pollen sterility, it is important to test the plants under different environmental conditions; the sterility must be strengthened by crossing with stable lines.

2645 Poncová, J.
Pokusy o prodloužení životaschopnosti pylu kukuřice (*Zea mays* L.) konzervací.
(Experiments on extending the viability of maize pollen by preservation).
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1959 : **32** : 1637–50.

Maize pollen lost its viability when it was dried over chemicals such as sulphuric acid or calcium chloride and when it was kept at a low temperature; a combination of these treatments was also unsuccessful. But the pollen remained viable for 14 days when stored with solid carbon

dioxide at — 78° C. after being dried by lyophilization. Details of this procedure are provided.

2646 Augustin-Bachmanowa, S.
Ocena przydatności materiałów pochodzących z sześciu odmian kukurydzy dla przemysłu krochmalniczego. (**Evaluation of the suitability of materials from six maize varieties for the starch industry**).
Hodowla Roślin Aklimatyz. Nasiennictwo 1959 : **3** : 173–93.

Preliminary data on the yield of starch per ha., the chemical composition of the grain, the proportions of husk and germ in the grain, the starch percentage of the grain and the quality of the starch in six Polish varieties indicate that these are equal to introduced varieties in their suitability for the starch industry.

2647 Mostovoj, K. & Cetl, I.
Možnosti využití metody zkoušek za chladu při vyšlechtění chladuvzdornější kukuřice. (**Possibilities of using methods of cold tests in breeding maize with improved resistance to cold**).
Sborn. čsl. Akad. aeměd. Věd : Řada rostlinná Výroba 1959 : **32** : 1593–610.

Two reliable methods of determining resistance to low soil temperatures have been developed; the seeds are sown in earth in boxes or dishes and kept for several weeks at a temperature of 5·5 ± 1·5° C. Many varieties, hybrids and lines tested in this way showed marked differences in cold resistance. Kočovská raná [Kočovce Early] was the most resistant of the Czechoslovakian varieties.

2648 Segeťa, V.
Otázka chladuvzdornosti kukuřice při vzcházení. (**The question of the cold resistance of maize at germination**).
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 307–18.

Soil temperature was found to have considerable effect on germination; at 10° C. many seedlings die at an early stage and do not emerge from the soil. Varieties differed in their ability to germinate at low temperatures and Stupická rana [Stupice Early] gave good results at 10° C.

2649 Nelson, R. R.
The genetics of compatibility in *Cochliobolus carbonum*.
Phytopathology 1960 : **50** : 158–60.

Segregation of ascospore isolates indicated that compatibility was controlled by a single major locus, as reported for *C. sativus* and *C. heterostrophus*. Isolates studied in ascus progenies also segregated in a 1 : 1 ratio for compatibility. Variability in degree of compatibility among conidial isolates, as well as differences in backcross fertility of ascospore isolates, suggested that other genes for incompatibility influenced the action of the major locus.

2650 Wernham, C. C.
Corn stalk rot trials in Pennsylvania 1958.
Plant Dis. Reptr. 1959 : **43** : 863–70.

Six inbred lines of hybrid corn were compared for reaction to *Gibberella zeae*. The most resistant was Ind 38–11. It is suggested that any of the lines studied could be improved by inoculation and reselection.

2651 Vožďová, G.
Charakteristika virulence chlamydospor a spordií *Ustilago zeae* (Beckmann) Unger při umělé infekci kukuřice. [**The characteristic virulence of chlamydospores and sporidia of *U. zeae* (Beckmann) Unger in artificial infection of maize**].
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1959 : **32** : 1683–92.

Chlamydospores and sporidia were found to differ in their virulence on maize, when a similar method of infection was used in each case. It is suggested that, in testing maize for resistance to *U. zeae*, the plants should be given either one injection with a suspension of sporidia or two or three injections with a suspension of "conidia" produced from sporidia in culture, when they have 3–9 leaves. Low air humidity and high temperature favour the development of the fungus.

2652 Le Conte, J.
Contribution à l'étude génétique de la résistance du maïs à la rouille (*Puccinia polysora*) et résultats pratiques obtenus au Dahomey. [**A contribution to the genetic study of resistance in maize to rust (*Puccinia polysora*) and some practical results obtained at Dahomey**].
Riz et Rizic. 1959 : **5** : 98–116.

The inheritance of rust resistance in a Dahomey population is described, and it is concluded that a number of genes are involved. It is estimated that the disease can reduce the yield by as much as one third. From a study of intervarietal hybrids involving single and double back crosses to the local parent, it is concluded that increase in yield in resistant lines is

attributable in part to productivity genes which are held to be associated with resistance genes. [Cf. XXVI, 1278].

2653 Young, H. C. *et al.*
An ecological study of the pathogenicity of *Diplodia maydis* isolates inciting stalk rot of corn.
Plant Dis. Reptr. 1959 : **43** : 1124–29.

F_1 single crosses of maize were inoculated in Minnesota, Missouri and Oklahoma with isolates of *Diplodia maydis* obtained in each state, the experiments being repeated in 3 different years. All these varieties and their interactions with pathogen isolate, location and year significantly affected the development of stalk rot.
The pathogenicity of the various isolates was related to their temperature requirements, that from Minnesota being more pathogenic in its state of origin, where the season is generally cool and moist; those from the other states grew better at higher temperatures and were also more pathogenic in the state of origin. The resistance of the varieties was generally greatest in Minnesota.

2654 Šapiro, I. D., Kolomycev, G. G. & Ryžkova, E. V.
(The importance of growth rate of leaves in maize for its resistance to injury by frit fly).
Agrobiologija (Agrobiology) 1959 : No. 2 : 208–12. [Russian].

The capacity of a variety to withstand larval attack of *Oscinella frit* was positively correlated with rapid growth rate of the third and fourth leaves in experiments carried out at Puškin. The least severe injury occurred to plants of Gollandskaja 29 [Dutch 29], Gollandskaja Gibridnaja 37 [Dutch Hybrid 37] and Odessa 10, which are varieties with a medium or a long growth period.

2655 Pathak, M. D. & Painter, R. H.
Geographical distribution of the four biotypes of corn leaf aphid, *Rhopalosiphum maidis* (Fitch), in Kansas.
Trans. Kans. Acad. Sci. 1959 : **62** : 1–8.

Investigations during 1956 and 1957 showed four biotypes (KS–1 to KS–4) of *R. maidis* to be distributed fairly widely in Kansas. Different biotypes were recognized in the same field and, in a few cases, even in the same colony.

2656 Gorter, G. J. M. A.
Breeding maize for resistance to streak.
Euphytica, Wageningen 1959 : **8** : 234–40.

P x H maize, developed in South Africa, is resistant to streak, but its F_1 progeny with susceptible varieties is only tolerant. In top-cross trials of P x H, the inbreds A21 and 33–16 showed the best combining ability. Further trials of three-way crosses were made and as a result production of the hybrid (A17 x 33–16) x (P x H) was begun; seed is now available for distribution under the designation SA31.
New sources of streak resistance have been found in the Mexican inbreds Mex. 37–5, Urq. 54 and Gto29–29A–5–4, all of which are, however, susceptible to *Helminthosporium* leaf blight. Two yellow varieties, the Caribbean maize Yellow Bounty and the Rhodesian inbred 3NA, are also resistant to streak.

BARLEY

2657 Hermelin, T.
Acute γ-irradiation and barley development.
Kungl. LantbrHögskolans Ann. 1959 : **25** : 327–39.

The effects upon growth and fertility of radiation before, during and after meiosis and at intervals up to the beginning of endosperm formation were studied in Bonus and Erectoides 23 in 1956–58. Total doses of 2250, 2000 and 1800 r., each at two intensity levels, were given in the respective years. In each case, the earliest treatments had the greatest effect, causing stunting and often complete sterility, and the severity of the effect was greater at the higher intensity level. In a study of doses of 600 and 200 r. in 1958, growth inhibition and reduction in fertility were slight after the earliest, pre-meiotic dose but were greater after the second and third, which were given during meiosis.

2658 Hentrich, W.
Die Anwendung radioaktiver Isotope in der Pflanzenzüchtung. **(The use of radioactive isotopes in plant breeding).**
Wiss. Z. Univ. Jena : Math.-Naturwiss. Reihe 1958/59 : **8** : 443–44.

The principles of the use of Co^{60} for exogenic irradiation and of P^{32} for endogenic irradiation are outlined. In treatments of grains of the barley Saale with solutions containing P^{32}, pre-soaked seeds did not appear to be more sensitive than dormant seeds; the amount of damage, assessed from growth rate, survival rate, fertility and other characters, was correlated with the final quantity of P^{32} absorbed. When treated at the seedling stage, the plants proved more susceptible in water culture than in sand

culture. No fixed relation between survival rate and fertility was found. Treatment prior to meiosis caused appreciable disturbances of fertility; more severe treatment at the time of meiosis, however, hardly affected fertility but decreased 100-grain weight and viability.

2659 Ştefan, I.
Comportarea cîtorva soiuri şi linii de orzoaică în condiţiile Staţiunii experimentale agricole Suceava. (**Behaviour of some varieties and lines of spring barley under the conditions of the Suceava Agricultural Experimental Station**).
Stud. Cercet. şti., Biol. Şti. agric. Iaşi 1958 : **9** : 139–43.
Trials of three varieties and two experimental lines during 1954–57 are reported. The two lines 51/21 and 51/22 outyielded the control, Hanna Kargyn.

2660 Botezan, V.
Rezultatele experienţelor cu soiuri de orz de toamnă din anii 1954–1956, la Staţiunea experimentală agricolă Cîmpia Turzii. (**The results of experiments with winter-barley varieties during the years 1954-56 at the Cîmpia Turzii Agricultural Experimental Station**).
Stud. Cercet. Agron., Cluj 1958 : **9** : 95–102.
Nineteen Rumanian and introduced varieties were tested, data being collected on yield, vegetative period, resistance to frost and lodging and chemical composition of the grain.

2661 Bălăşoiu, A.
Comportarea orzului de toamnă în Ţara Bîrsei. (**Behaviour of winter barley in Ţara Bîrsei**).
Probl. Agric., Bucureşti 1958 : **10** : No. 7 : 25–29.
Trials of seven varieties at the Magurele research station are reported, data being provided on yield, resistance to diseases and lodging, earliness and chemical composition of the grain. Cenad 396 did best.

2662 Hagberg, A.
Grundläggande forskning inom växtproduktionen. (**Fundamental research in crop production**).
K. Skogs- o. Lantbruksakad. Tidskr. 1959 : **98** : 450–56.
In this report of a lecture given on 22 October 1959 at a meeting in Stockholm on Agriculture and research, a gene map of the seven barley chromosomes is presented and reference made to genes controlling such characters as plant height, growth rate, photosynthetic ability and grain quality. The application of the genetical findings mentioned to plant breeding and crop production is discussed.

2663 Bhide, V. S.
A note on the manifestation of hybrid vigour in barley.
Sci. & Cult. 1959 : **25** : 138–39.
BR_{22} and $Type_{11}$ were crossed at the Agricultural Research Institute, Sabour, Bihar, in order to introduce the lodging resistance and earliness of the latter parent into the former. The back crosses to both parents combined high yield, earliness and high numbers of tillers, being superior to the F_1 and F_2 in these respects.

2664 Wagenaar, E. B.
Intergeneric hybrids between *Hordeum jubatum* L. and *Secale cereale* L.
J. Hered. 1959 : **50** : 195–202.
Two hybrids of *H. jubatum* ($2n = 28$) ♀ x *S. cereale* ($2n = 14$) ♂, one involving Antelope and the other Sangaste as the rye parental variety, were raised with the aid of embryo culture. Both hybrids ($2n = 21$) were perennial and completely sterile, the majority of morphological features being intermediate between those of the parents. No multivalents were observed at meiosis in either of the parental species. In the hybrids, the rye chromosomes could be distinguished as being larger than the *H. jubatum* chromosomes, which showed fairly strong autosyndesis, on the average forming $5{\cdot}9_{II}$ and $9{\cdot}1_{I}$. The rye chromosomes were mostly seen as univalents. In the hybrid having Sangaste as rye parent, autosyndetic bivalents and multivalents were however regularly formed among the rye chromosomes, as well as some associations between the rye and *H. jubatum* chromosomes. *H. jubatum* is probably a segmental allotetraploid.

2665 Scholz, F. & Lehmann, C. O.
Die Gaterslebener Mutanten der Saatgerste in Beziehung zur Formenmannigfaltigkeit der Art *Hordeum vulgare* L. s.l. II. (**The Gatersleben mutants of grain barley in relation to form diversity in the species *H. vulgare* L. s.l. II**).
Kulturpflanze, Berlin 1959 : **7** : 218–55.
Morphological descriptions are given of 49

X-ray-induced mutants of the winter barleys Friedrichswerther Berg [Friedrichswerth Mountain], Peragis Mittelfrühe II [Peragis Medium-early II], Kleinwanzleben 12 and Mahndorf. The mutants are placed in 10 varieties of the convariety *hexastichon*. In var. *hybernum*, there are two mutants characterized by a long stem, three with a short stem, one with bent internodes, two with waxless leaves, one with wide leaves, three with narrow leaves, three combining narrow leaf with waxiness of the whole plant, two characterized only by the waxiness of the plant, one with waxy glumes, three with white glumes, one with brown glumes, one with the lemma having a slight extraversion, two with wavy awns, two with very wavy awns and bent internodes and two with spreading awns. One mutant with short awns and five with short and brittle awns are assigned to var. *breviaristatum*. In var. *semiaristatum* are placed two mutants with very short awns, one with very short awns and a short stem and one with very short awns having spatulate outgrowths. A mutant with a lemma having a three-pronged appendage and a strong terminal awn is placed in var. *tortile* and a mutant with a similar lemma distinguished by a more delicate terminal awn is assigned to var. *cucullatum*. In var. *latiglumatum* is a mutant with wide-awned empty glumes and three mutants with dense ears are in var. *parallelum*; one mutant with dense ears and short awns is in var. *subparallelum*. A mutant with branched ears is in var. *crispum* and two mutants with very dense ears are in var. *densum*. Most of the distinguishing characters of the mutants are monogenic and recessive. The character short and brittle awns has shown three degrees of expression and appears to be controlled by a series of alleles designated *fragilis*^{exigua}, *fragilis*^{mediocris} and *fragilis*^{distincta}, the dominance relationship being *Fra* > *fra*^{ex} > *fra*^{med} > *fra*^{dis}.
Tabulated information is provided on other mutants described elsewhere [cf. XXIX, 2626].

2666 Moës, A.
Les mutations induites par les rayons X chez l'orge distique (*Hordeum sativum* Jess. subsp. *distichum*). (**The mutations induced by X rays in the two-rowed barley *H. sativum* Jess. subsp. *distichum*).**
Bull. Inst. agron. Gembloux 1958 : **26** : 335–61; 1959 : **27** : 167–221.
Seeds of the varieties Kenia, Herta and Piroline were subjected to various X-ray doses and the range of mutations was investigated over four generations. The following are considered: chlorophyll mutants (mostly deficient but including one dark-foliage mutant in Piroline), tiller habit, colour of foliage at the time of stem emergence and its association with drought resistance, leaf form (rolled, crinkled, liguleless and supplementary leaves), position of last leaf at flower formation, presence, absence and heaviness of bloom, colour of straw and ear, number of rows in the ear (gradation from complete sterility of lateral florets to complete fertility was obtained), length and compactness of ear, awn characters, position and orientation of ears, development (as measured by the relative dates of flowering and maturity, and height at maturity), resistance to lodging and to insect and fungal attack, and finally, productivity as measured by tillering capacity and the number, weight and quality of the grain.
A discussion of the pleiotropic effects observed is followed by a consideration of the possible role of some of these mutants in plant improvement. The author lays particular stress on the importance of third and even fourth generation analysis for the satisfactory recovery of mutants.

2667 Kamra, O. P. & Nilan, R. A.
Multi-ovary in barley.
J. Hered. 1959 : **50** : 159–65.
A detailed account is given of investigations on a multiovary mutant (*mo*) of Trebi [cf. XXIX, 1019].

2668 Eikeland, H. J.
Forus-bygg. (**The barley Forus**).
Bondevennen 1960 : **63** : p. 58.
This new six-rowed variety, from Jadar x Asplund, has stiffer straw than Jadar II and gives higher yields; in some areas it has outyielded the best two-rowed varieties. Its grain quality is also good. Its chief disadvantage is its tendency to shatter, so that combine harvesting has to be carried out at the stage of yellow ripeness.

2669 **Seed bulletin. Barley.**
IVRO, Wageningen 1959 : Pp. 12.
The chief characters of 17 spring and winter barleys are described and data on their yields and acreage in the Netherlands given. Two new spring barleys, Delta and Heine Fr.9, are included. Delta, bred at the Centraal Bureau, Rotterdam, from Kenia x CB 28·6/37–11, is a short, stiff-strawed fodder barley suited only to fertile heavy soils, on which it has given high yields. Heine Fr.9, a German six-rowed variety,

was developed from Cape Coast x Isaria, and is early, has stiff straw and gives high yields.

2670 MacDonald, M. D.
Studies in the building of large chromosome rings in barley.
Diss. Abstr. 1959 : **20** : LC Card Mic 59–2363 : p. 38. (Abst.).

"This study included attempts in barley to build rings with a large number of chromosomes by selection of crossovers in the differential segment in the progenies of crosses between translocations with a common chromosome. The interchanges crossed were *C1483* (*b–g*) *x Ert 7* (*a–b*), *C1358* (*b–d*) *x C1483* (*b–g*), XT4 (c–f) x XT13 (c–g), *C1025* (*b–d*) *x XT15* (*d–f*), *XT15* (*d–f*) *x C1358* (*b–d*), C1433 (f–g) x XT4 (c–f), *C1483* (*b–g*) *x C1433* (*f–g*), and *C1483* (*b–g*) *x XT13* (*c–g*). The common chromosome was *b* in two different crosses, *c* in one, *d* in two, *f* in one, and *g* in two. The crosses italicized were the ones which, on the basis of previous cytogenetic information, should have had a long differential segment. Selection of possible crossovers in F_2 progenies and in test crosses (normal *x* F_1) was made on the basis of pollen and ovule sterility and cytological analysis at meiosis.

"Although the average number of plants classified for each of the eight crosses was 1256 (range 922 to 2160), not a single crossover was obtained that combined the two interchanges. The few in each progeny that were classed as other than non-crossovers included a number of plants identified cytologically as trisomics and a number that were sterile and probably trisomic. Failure to identify a plant with the crossover may have been the result of (1) an inadequate method of selection, although selection did identify some trisomics with sterility similar to that expected for the crossover, and (2) greatly reduced crossing-over in the differential segment plus either a very low frequency of crossing-over in the appropriate interstitial segment and alternate segregation of centromeres or a very low frequency of the appropriate adjacent-alternate segregation.

"Plants with a ⊙6 had about 50 per cent pollen abortion. The segregation of '50 per cent sterile' and normal plants in the progenies of plants with a complex of six chromosomes was close to the expected 1 : 1 ratio in all but one cross, C1025 x XT15. This hybrid, which formed chains as well as rings of six chromosomes, had an excess of '50 per cent steriles' in two out of 10 progenies. The cause of this deviation was not established, but it may have been a chance deviation.

"The cytological position of the Ert 7 (a–b) interchange on chromosome *a* was determined from measurements made of pachytene chromosomes from a plant heterozygous for the interchanges C1483 (b–g) and Ert 7. The position, measured from the centromere, is at 0·17 on the short arm of chromosome *a* or 5. This Ert 7 translocation point is denoted as 5S·17.

"Cytological analysis, at meiosis, of hybrids of different *b–g* interchanges provided information on the probable positions of the translocation breakage points. The observed chromosome configurations at metaphase in the F_1 were C1483 x C1315 a ⊙4, C1483 x C1376 ♯ 2 a ⊙4 and 7II, C1483 x C1462 a ⊙4, C1315 x C1376 ♯ 2 a ⊙4 and chain of four, C1315 x C1462 7II, and C1376 ♯ 2 x C1462 a ⊙4 and chain of four. Since root tip studies definitely established the breaks in C1483 to be in the short arm of *b* and the satellite or short arm of *g*, the probable chromosome arms involved in the other interchanges based on the F_1 configurations at meiosis are: C1315 *b*–L, *g*–L; C1462 *b*–L, *g*–L, and C1376 ♯ 2 *b*–S,*g*–L.

"It is suggested that the stability of a large ring of chromosomes built by selecting crossovers in the differential segment may not be as great as a ring produced by irradiation with no selection for crossing-over in this region."

2671 Smith, W. E.
Fertility studies of autotetraploid varieties and hybrids of common barley, *Hordeum vulgare* L.
Diss. Abstr. 1959 : **20** : LC Card Mic 59–1791 : p. 38. (Abst.).

Differences in fertility, the effect of selection for fertility and the relationship between cytological behaviour and fertility were investigated in colchicine-induced tetraploids of several barley varieties and of their hybrids. The varieties and hybrids differed considerably in mean percentage fertility and each had a wide range in fertility. Fertility in the C_4 could be increased by selection within C_3 progenies of the hybrids but it was not possible to raise fertility in the 4*x* varieties by similar selection. All tetraploids were true breeding. Two-rowed 4*x* varieties were more fertile than six-rowed 4*x* types, but in all cases fertility was lower than in the 2*x* barleys. At metaphase I, the chromosomes were associated mainly as bivalents and quadrivalents, the mean number of the latter being 2. At anaphase I, 50% of the cells had the normal 14–14 chromosome distribution, 20% a distribution of 13–15 and the remainder 1–6 laggards. Many of the quartets contained micronuclei. Embryo sacs

of sterile florets developed normally but fertilization did not take place. The tetraploid varieties and hybrids did not appear to differ meiotically. Since the disparities in fertility found between 4*x* varieties and hybrids were not attributable to meiotic irregularities, it was concluded that genetically determined physiological sterility is at least partly responsible for the reduced fertility of 4*x* barley.

2672 Nečas, J.
Dědičnost energie klíčení u ječmene. (**The inheritance of germination energy in barley**).
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 105–14.
Several barley varieties were investigated and it was found that germination energy is genetically controlled.

2673 Finlay, K. W.
Genetic study of barley germination behaviour. I. Genetic and environmental variation.
J. Inst. Brew. 1960 : **66** : 51–57.
Applied at the Waite Agricultural Research Institute, Adelaide, a method of calculating a single numerical value as an index of germination behaviour (percentage germination/time relationship), based on germination under standard conditions after 24, 48 and 72 hr., is expounded. This value was used in the estimation of the range of genetic and environmental variation in 800 varieties. Using ten varieties chosen to represent the full range of available genetic variability in germination behaviour, a more detailed study was made of the influence of environmental conditions during growth upon this behaviour, the varieties being grown for several years under different soil-fertility and moisture conditions. Further experiments, in which the variation in individual seed performance with respect to actual time taken to germinate in relation to percentage increase in weight was determined in samples harvested from plots, single plants and single ears, provided information on the effect of the environment on a uniform genetic background.

2674 Finlay, K. W.
Genetic study of barley germination behaviour. II. General and specific combining ability.
J. Inst. Brew. 1960 : **66** : 58–64.
The ten varieties referred to in the previous abstract were crossed by the diallel method and for each variety the general and specific combining ability with respect to germination behaviour as previously defined was determined by the method already described. Two varieties constituted a rapidly germinating group, two others a slow group and the remaining six an intermediate group. Germination behaviour proved to be remarkably stable genetically. Although the ten parent varieties were grown under environmental conditions differing widely from those in the earlier study, they fell into substantially the same order as regards value for germination behaviour. The data on combining ability are analysed in detail with respect to their significance in breeding. Further work on the ten varieties and their behaviour during micromalting tests will be carried out to delineate more accurately the subdivision into rapid, intermediate and slow groups.

2675 **Quality evaluation of barley varieties and selections grown in 1958.**
Quality Publ. Malt. Barley Improv. Ass., Milwaukee 1959 : No. 16 : Pp. 16.
A report is given on pilot malting and brewing tests carried out on named varieties and selections at laboratories in the USA. On the basis of results from tests made during 1955–58, Parkland has been classified as an acceptable blue-aleurone barley comparable to Montcalm in malting quality; it is recommended for northeastern North Dakota and northwestern Minnesota where formerly Montcalm was successfully grown.

2676 Hudson, L. E.
Some observations on barley quality.
J. Inst. Brew. 1959 : **65** : 473–78.
"Statistical relationships which can be established between a property of barley and another property of its malt—e.g. the nitrogen-extract equation—may help to predict malt quality from barley analyses, but these relationships must be applied only to the variety of barley from which they were originally derived. Such environmental correlations, which are useful to maltsters, may be unimportant for plant-breeders, who are interested in genetic correlations. It is thus not always appropriate for breeders to rely on tests of barley quality which appeal to maltsters. Just as, in interpreting barley analyses a maltster is using some correlation between barley properties and malt, so in examining malt analyses a brewer is, possibly unconsciously, correlating the analysis with the finished beer. If, as seems probable, there is some varietal effect in the correlation of malt and beer properties, then trial brewing, in

addition to barley and malt analyses, must become an essential part of variety testing."
[Author's summary].

2677 Spasojević, V.
Jaroozimi pivski ječam. (**Spring-winter malting barley**).
Arh. poljopr. Nauk. 1959 : **12** : 3–10.
Introduced barley varieties having proved unsatisfactory in Yugoslavia, local varieties of *Hordeum distichum* var. *nutans* were studied and found suitable for brewing. To improve their winter hardiness and resistance to lodging and mildew, the best lines were crossed with Šestoredac iz Freske [Freske Six-rowed], and from the hybrid material thus obtained two varieties, 1 and 25, were finally selected. Both lines were selected for ability to grow both as autumn-sown and as spring-sown crops; they were better in quality when sown in autumn, showing a higher 1000-grain weight and hectolitre weight and a lower protein content, but were also satisfactory when sown in spring.

2678 Grillot, G.
Note sur la classification botanique des orges cultivées. Création de nouvelles variétés. (**A note on the botanical classification of cultivated barleys. The creation of new varieties**).
CR Soc. Sci. nat. phys. Maroc 1957 : No. 8 : 156–62.
A simple classification scheme for the ready identification of subspecies of *Hordeum sativum* is outlined. The scheme is designed to accommodate new subspecies and a detailed study is to be presented in a subsequent paper.

2679 Pollhamer, E.
Lisztharmat rezisztencianemesítési kísérletek tavaszi árpával. II. (**Experiments on breeding for mildew resistance in spring barley. II**).
Magyar tud. Akad. Agrártud. Oszt. Közl. 1959 : **16** : 411–22.
A total of about 50 varieties in the spring-barley collections of the Martonvásar Agricultural Research Institute and the Agrobotanical Research Institute, Hungary, have proved immune or highly resistant. Seedling resistance in Heine's Haisa II crossed with the susceptible MFB104 was governed by two recessive genes [cf. XXIX, 2649], but only 28 of the 58 plants resistant in the greenhouse were also resistant in the field. Selections of these have been made. The greenhouse and field immunity of Halle 4592/51 in crosses with MFB104 and MFB102 was dominant and monogenic and back crosses to the two latter parents have been made. MFB104 has also been crossed with the four resistant varieties Palestine 10, Gopal CI1091, Anoidium 35–3 and Multan Glabron.

2680 Shih, S. C., Elliott, E. S. & Veatch, C.
A study of *Erysiphe graminis* races on barley in West Virginia.
Plant Dis. Reptr. 1959 : **43** : 1282–83.
A new race is reported, designated race 22, obtained from conidia on the barley variety Goldfoil. It gives similar reactions to race 20 except for increased severity on Goldfoil and differs from race 21 in greater pathogenicity on Nepal.

2681 Moseman, J. G.
Strain dynamics of powdery mildew of barley, *Erysiphe graminis* f. sp. *hordei*, in North America.
Plant Dis. Reptr. 1959 : **43** : 1004–09.
New pathogenic strains have been isolated from British Columbia, Ontario and the N.E. United States. Those from British Columbia had pathogenicity differing from that of race 3 previously isolated in that area in that they were pathogenic to barley varieties Rabat (CI4979), Algerian (CI1179) and Marocaine 079 (CI8334), which had hitherto been immune or highly resistant. The similarity of reaction of these three varieties to different cultures of the pathogen suggests that their reaction is conditioned by a common gene.
Cultures from Ontario and the N.E. United States were similar to those of races 8 and 9 previously isolated in that area, except for their pathogenicity to Modia (CI2483), Ricardo (CI6306), Goldfoil (CI928) and Stephan (CI8051). In 1956 and 1957, cultures were isolated which were pathogenic either on the first two or on the last two of those named. In 1958, cultures pathogenic on all four varieties were isolated. As Goldfoil is one of the standard differentials used in determining physiologic races of the pathogen, a new race, designated race 21, to which this variety is susceptible, is inferred to have arisen. There is evidence that the same gene may control reaction in Goldfoil and Stephan.

2682 Hoffmann, W. & Nover, I.
Ausgangsmaterial für die Züchtung mehltauresistenter Gersten. (**Initial material for breeding mildew-resistant barleys**).
Z. Pflanzenz. 1959 : **42** : 68–78.
It is pointed out that resistance to *Erysiphe graminis* in barleys cultivated in Germany

depends on only a few genetic factors effective against individual races. The recent rapid increase in races which are not affected by this resistance has made clear the necessity for breeding for resistance on a wider genetic basis. Suitable material for such a programme has been found in spring barleys from Abyssinia, spring and winter barleys from the Balkans, winter barley from Anatolia, spring barley from India and various mutants of commercial varieties induced by X irradiation. Tabulated information on the resistance of these foreign barleys to several races of mildew is given; the barleys belong to various taxonomic groups.

2683 Andersen, A. H. & Lund, S.
An investigation of the presence of a morphologic indicator of loose-smut infected barley seedlings.
Plant Dis. Reptr. 1959 : **43** : 1122–23.

A shortening of the leaf sheath has been found to be a consistent seedling marker indicating infection by *Ustilago nuda* in the one barley variety Weibull's 5425. The remainder of 20 varieties tested showed no correlation between a shortening of the leaf sheath and smut infection.

2684 Heinrich, J.
Wyniki doświadczeń ze sztucznym zakażaniem odmian jęczmienia ozimego głownią zwartą (*Ustilago hordei* Pers.) [**Results of experiments on artificial infection of winter barley varieties with covered smut (*U. hordei* Pers.)**].
Hodowla Roślin Aklimatyz. Nasiennictwo 1959 : **3** : 143–50.

Polish tests with 27 varieties indicated that the Zade and Harring method of inoculation under partial vacuum may prove satisfactory if sufficient material is used. Only Carstens Zweizeiliger [Carsten's Two-rowed] and Mansholts Groninger were completely resistant. Because of the occurrence of different physiological races, it is desirable to inoculate with samples collected from many different localities.

2685 Nover, I. & Mansfeld, R.
Resistenzeigenschaften im Gersten- und Weizensortiment Gatersleben. 3. Prüfung der Gersten auf ihr Verhalten gegen Zwergrost (*Puccinia hordei* Otth). [**Resistance characters in the barley and wheat collection at Gatersleben. 3. Testing barleys for their reaction to dwarf rust (*P. hordei* Otth.)**].
Kulturpflanze, Berlin 1959 : **7** : 29–36.

Greenhouse and field tests were carried out on 724 spring barleys and 265 winter barleys using three races of *P. hordei*; one of these was very similar to Straib's race 15 and two, H10 and H16, were hitherto unknown. H16 was far more frequent in central Germany than the other races. None of the varieties tested was resistant to all three races but 13 varieties showed resistance to one or two races. The results showed that some of the varieties were not genetically pure. Several strains combining resistance to *P. hordei* with resistance to *Erysiphe graminis* are mentioned as being useful for breeding.

2686 Moseman, J. G. & Roane, C. W.
Physiologic races of barley leaf rust (*Puccinia hordei*) isolated in the United States from 1956 through 1958.
Plant Dis. Reptr. 1959 : **43** : 1000–03.

Six physiologic races were isolated during 1956–58, and 70% of the isolates obtained were of race 4. Seedling reactions of 16 differential barley varieties to eight cultures, mostly of race 4, were tested. Two of these, Cebada Capa (CI6193) and Aim (CI3737), were resistant to all eight cultures.

2687 Reed, H. E.
Studies on *Rhynchosporium secalis* (Oud.) Davis causing scald of barley.
Diss. Abstr. 1959 : **20** : LC Card Mic 59–2305 : p. 49. (Abst.).

[Cf. XXIX, 1551].

MILLETS AND SORGHUMS

2688 Kosarev, M. G.
(The new millet variety Kamyšin 123).
Selekcija i Semenovodstvo (Breeding and Seed-growing) 1959 : No. 2 : 72–73. [Russian].

The above variety of *Panicum* millet was obtained by single plant selection from a form originating in Saratov at the Kamyšin breeding station. It is a lodging-resistant midseason type, with superior technological and cooking properties to Saratov 853. In recent Kazah and Ukrainian trials it outyielded Saratov 853 in most years.

2689 Chandola, R. P.
Cyto-genetics of millets.
Cytologia, Tokyo 1959 : **24** : 115–37, 149–64.

Meiotic and mitotic observations on the following are reported: several varieties of *Eleusine coracana*, $2n = 36$; *E. indica* and *E. verticillata*, both with $2n = 18$; *Dactyloctenium aegyptium*, $2n = 36$; *Panicum miliaceum*, *P. crusgalli*, *P.*

colonum and *P. isachne*, all with $2n = 36$; *P. maximum*, $2n = 32$; varieties of *Setaria italica*, $2n = 18$; *S. verticillata* and *S. glauca*, both with $2n = 36$; *Pennisetum typhoides*, $2n = 14$; and *P. purpureum*, $2n = 28$. In all species of *Panicum* multivalents were frequently formed and pollen fertility was reduced as the result of meiotic irregularity. Multivalents were also observed in *P. purpureum*. Meiosis was regular in *Eleusine*, *Setaria*, *Pennisetum typhoides* and *D. aegyptium*. The effect of polyploidy upon cell and nuclear size and other characters in the millets is examined. Stoma and pollen-grain size are considered to be criteria of polyploidy in *Eleusine*, *Setaria* and *Pennisetum*. Secondary association suggested that in *Eleusine* and *Dactyloctenium* $x = 7$ and in *Setaria* $x = 5$. On the basis of observations on secondary association, formulae are given for the haploid genome of *E. indica*, *E. verticillata*, *E. coracana*, *D. aegyptium* and *S. italica*. The possible role of allotetraploids and autopolyploids in species differentiation in the millets is discussed. *E. coracana*, *S. verticillata* and *S. glauca* may have originated as allotetraploids from crosses between parents each with $n = 9$, while two tetraploid species of *Panicum* and *Pennisetum* may have arisen through autopolyploidy. The results support the view that the basic chromosome number of the Gramineae is $x = 7$, $x = 5$ and other deviating numbers being modifications. A hypothetical scheme is presented which shows the possible course of evolution of the millets from ancestral species with $n = 9$. Finally, possible factors affecting chromosome pairing in *Panicum* spp. and causes of sterility in this genus are discussed in detail.

2690 Maslovskij, A. D.
(The resistance of millet to smut).
Agrobiologija (Agrobiology) 1959 : No. 2 : 203–07. [Russian].
The results of resistance trials here reported essentially agree with those already summarized [cf. XXIX, 3872].

2691 Subramaniam, A. & Sivagnanam, L.
Ragi Co. 7 is an ideal strain for cotton-ragi rotation.
Madras agric. J. 1959 : **46** : p. 483.
Eleusine coracana 'Co. 7' is suitable for use in rotation with cotton in the Coimbatore district of Madras State on account of its early maturity.

2692 Divakaran, K.
A new species of *Eleusine* (Gaertn).
Madras agric. J. 1959 : **46** : 485–86.
A description is given of *E. reniformis* ($2n = 36$), a new species to which a sample received from East Africa has been assigned as the result of observations at the Millet Breeding Station, Coimbatore, Madras. It bears reniform grains.

2693 Niqueux
Les sorghos d'hivernage au Tchad: variétés, répartition, amélioration. **(Winter sorghums in Chad : varieties, distribution and improvement).**
Riz et Rizic. 1959 : **5** : 80–93.
Botanical descriptions are given, together with patterns of distribution, for each of the six species grown during the rainy season. High-yielding strains are being selected from local varieties, and hybridization programmes designed to produce shorter plants and plants suitable for both seed and fodder are in progress. With the introduction from Texas of a strain exhibiting cytoplasmic male sterility, attempts are being made to transfer this character to local varieties.

2694 Săulescu, N. & Cîrnu, I.
Rezultatele experienţelor cu varietăţi şi distanţe la sorgul pitic. **(The results of experiments on the effect of variety and distance in dwarf sorghum).**
Probl. Agric., Bucureşti 1959 : **11** : No. 5 : 55–58.
In experiments at Fundulea using hybrid sorghums sown at three different densities, the highest yields were given by NK3013, Pioneer 780 and NK3009.

2695 Bottanelli, P.
Sorghi ibridi da granella. **(Hybrid grain sorghums).**
Agric. bresciano 1960 : **7** : No. 12 : p. 2.
Hybrid sorghums have not only given higher grain yields than open-pollinated varieties in arid areas of Italy without irrigation but have exceeded hybrid maize by 30–100%, their superiority being particularly evident in the driest years. They have short strong straw and can be combine-harvested. Comparative tests of a number of hybrids showed Funk's S1, R12 and Camelsorgo 59 to be the best in grain yield, having given 105·18, 103·70 and 103·93 c. per ha. in conditions where Wisconsin 641 AA maize gave 81 c. Other tests have given equally satisfactory results and figures are presented to show that the grain is not inferior to maize in nutritive qualities.

2696 **New grain sorghum for southern California.**
Crops & Soils 1960 : **12** : No. 5 : p. 18.
A new selection of Dwarf Imperial Kafir grain sorghum known as MF1955 originated from a single plant found in a plot at the Imperial Valley Field Station, California. It was selected for its shorter plant height and more compact head; in other respects it closely resembles Dwarf Imperial Kafir.
The selection is a medium-late to late variety and is suitable for combine harvesting. It has shown a high degree of uniformity under the hot, dry conditions of southern California.

2697 Krishnaswamy, N., Raman, V. S., Chandrasekharan, P. & Krishnaswami, D.
A note on hexaploid sorghum.
Curr. Sci. 1959 : **28** : 499–500.
A hexaploid sorghum was obtained from the fertilization of an unreduced ovum of the desynaptic autotetraploid *S. subglabrescens* ($2n = 40$) with reduced pollen from the allotetraploid *S. halepense* ($2n = 40$). The hybrid was vigorous, tall and tillered moderately. Seed setting varied from 3·4% to 27·8% and seed characters resembled those of the male parent.

2698 Celarier, R. P.
Cytotaxonomy of the Andropogoneae. III. Subtribe Sorgheae, genus *Sorghum*.
Cytologia, Tokyo 1958 : **23** : 395–418.
This survey begins with a short account of the taxonomic history of the genus *Sorghum* and a key to the five subgenera, *Para-sorghum*, *Stiposorghum*, *Eu-sorghum*, *Chaetosorghum* and *Heterosorghum*. Otherwise accepting Garber's subgeneric classification, the author assigns *Sorghastrum* to a separate genus. The cytology of the genus, of which 45 species are now known, is reviewed. The chromosome number of *S. conspicuum*, *S. aethiopicum*, *S. niloticum* and *S. timorense* is reported for the first time ($2n = 20$). Both autopolyploidy and allopolyploidy are of common occurrence in the genus. Autopolyploids appear, however, to be restricted to *Para-sorghum* and *Stiposorghum*. Intraspecific polyploidy occurs in two species, *S. nitidum* ($2n = 10, 20$) and *S. plumosum* ($2n = 20, 30$). The geographical distribution of the subgenera and individual species and work on interspecific hybridization are briefly surveyed. The paper concludes with a discussion of phylogenetic relationships between the subgenera, as suggested by morphological and cytological observations.

2699 Halisky, P. M., Smeltzer, D. G. & Houston, B. R.
Head smut of Sudan grass and sorghum in California.
Plant Dis. Reptr. 1959 : **43** : 1084–90.
Cross-inoculation tests with soil-borne spores from smutted Sudan grass and grain sorghum showed that cross-infection of each and of sorgo took place. Of six varieties of Sudan grass tested only Lahoma was immune, and Tift and Piper showed a low degree of infection. Sudan 23, with moderate susceptibility, was developed by selection from common Sudan grass. The other five varieties tested all have the highly susceptible Leoti sorgo in their parentage, which suggests that their reaction to smut may depend on the particular plants of common Sudan grass used in their development.

RICE

2700 Nicaise, P.
Recherches radiobiologiques chez *Oryza sativa*. I. Effets globaux des rayons X. (**Radiobiological research on *O. sativa*. I. Total effects of X rays**).
Genetica 1959 : **30** : 324–45.
Observations were made on the plants produced from seeds of the variety 150 Eiko subjected to X-ray doses of 2000, 5000, 10,000 and 15,000 r. While most of the effects observed were harmful, an increase was noted in the earliness of spike formation, average weight of fertile panicles, total number of spikelets and the number of spikelets per cm. of the panicle at X-ray doses of 2000 and 10,000 r.

2701 **Annual Report of the West African Rice Research Station 1958** (1959) : Pp. 31.
Information is provided on recent introductions showing promise. With the increase in numbers of introduced varieties under test and with greater attention being paid to hybridization, selection of improved types from local rices is being cut down. Production of a diallel series of crosses between four early varieties, Lead, BG79, Faya and HR8, was initiated. It is hoped that a replicated trial of the F_1 from all six crosses, together with the parents, will give information for estimating combining ability, degrees of dominance and heterotic components and for selecting the most promising parental combinations, according to the theoretical predictions worked out by Mather and Jinks. Putative hybrid seeds were obtained from *Oryza sativa* x *O. glaberrima*.

2702 Daskalov, H., Kacarov, K., Čilikov, I. & Milev, V.
(Studying Chinese drought-resistant rice varieties in Bulgaria).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1958 : **5** : 3–22. [Bulgarian].

It was found that many Chinese varieties have a considerably shorter vegetative period and are more productive than the early-ripening Bulgarian variety Pembe 62; these varieties, which are resistant to dry conditions, could be successfully cultivated with periodic irrigation. Mention is made of four varieties which were particularly high yielding; Hua-teng-pai was the best, its yield being in one test more than twice as great as that of Pembe 62. The four varieties equalled Pembe 62 in technological and chemical characters.

2703 Mizushima, U. & Kondo, A.
(Fundamental studies on breeding rice by hybridization between Japanese and foreign rices. I. Anomalous segregation of anthocyanin pigmentation observed in a hybrid between a Japanese variety and an Indian variety).
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 212–18. [Japanese].

The F_1 from crossing Norin 1 [Ministry of Agriculture and Forestry 1], a Japanese variety with red apiculi (C^BSp^dA) and Surjamkhi, an Indian variety with purple apiculi (C^BSpA), bore purple apiculi. In the F_2, however, instead of the expected 3 : 1 segregation of purple : red apiculi, 30% of the plants bore white or tawny apiculi and there was a marked deficit of plants with red apiculi. The F_3 progenies showed further complex segregation. In the F_2, segregation for partial sterility also occurred but was not associated with the pigmentation classes. The explanation of these results is not yet known.

2704 Kawase, T., Murata, N. & Yamane, K.
(Studies on the relation between the expression of genically determined characters and environment. II. The response of genes E_3, E_4 and E_5 to day length in rice).
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 227–36. [Japanese].

Extending their researches from loci E_1 and E_2 to E_3, E_4 and E_5 [cf. XXV, 3082 and XXIX, 1581], the authors investigated the effects of various photoperiodic treatments on genotypes $e_3e_4E_5$, $E_3e_4e_5$, $E_3e_4E_5$, $e_3E_4e_5$, $e_3E_4E_5$, $E_3E_4e_5$ and $E_3E_4E_5$. Heading date is retarded by increase in photoperiod, this effect being greatest with the dominant E alleles, and in particular E_4. The critical day length determining the time of differentiation of the ear primordium is most markedly affected by the E_4 locus.

2705 Hsieh, S.-C.
(Studies on hybrid sterility in rice. I. Cytogenetical investigations of sterility in hybrids between rices of the *indica* and *japonica* types).
Nung-yeh Yen-chiu/Agric. Res., Taipei 1957 : **7** : No. 3 : 51–61. [Chinese].

Numerous crosses were made between *indica* and *japonica* types originating from China, Taiwan, Japan, Indonesia and the USA. The principal cytological abnormalities observed were stretched chromosomes and bridges but there was scarcely any difference in frequency of occurrence of these aberrations between the parental varieties and their F_1 hybrids. It is concluded that chromosome inversions are an unlikely explanation of sterility in *indica* x *japonica* hybrids.

2706 Oka, H.-I. & Chang, W.-T.
The impact of cultivation on populations of wild rice, *Oryza sativa* f. *spontanea*.
Phyton, Vicente López 1959 : **13** : 105–17.

Studies were made at Taichung, Formosa, of the following populations from Raipur, Madhya Pradesh: I, *O. sativa* f. *spontanea* growing in swampy land; II, *O. sativa* f. *spontanea* growing amongst grass between two rice fields; III, *O. sativa* f. *spontanea* growing as a weed in a rice field; IV, the cultivated variety in which the preceding population was found; and V, *O. perennis* growing in a reservoir. On the basis of a scoring system involving 100-grain weight, panicle length, ligule length, length/width ratio of the grains, apiculus hair length and rachis number per panicle, populations I to IV were found to form a continuous series from truly wild to cultivated; presence of awns and heading date were also related to degree of wildness in these populations. Population V remained outside the array. Populations II and III contained a number of plants with semisterile pollen and gave higher estimates of heterogeneity and heterozygosity than I and IV. Also, II and III were intermediate between I and IV in degree of outcrossing, grain shedding and dormancy. Population V differed from all the others in its heterogeneity and heterozygosity, its greater amount of outcrossing, pollen sterility and shedding and its longer

dormancy period. It is concluded that the continuous variation found in populations I to IV is due to introgressive hybridization between wild and cultivated forms and subsequent selection under varying intensities of cultivation pressure.

2707 YAMAGUCHI, H.
(On the estimation of segregation of chlorophyll mutants in the progeny of irradiated rice).
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 128–34. [Japanese].

The frequencies of chlorophyll mutants in the progenies from separate mutant spikes of R_1 plants of Rikuu 132 treated with X rays and thermal neutrons and of Norin 29 [Ministry of Agriculture and Forestry 29] treated with thermal neutrons were estimated. The respective values were 0·2305, 0·1774 and 0·1770. The deviation of the neutron-induced mutants from the expected value of 0·25 is attributed to gametic elimination.

2708 YAMAGUCHI, H. & ANDO, A.
Radio-sensitivity of gamma-irradiated autotetraploid in rice.
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 169–71.

As indicated by observations on seedling growth, panicle number per plant, spikelet number per panicle and seed fertility in the R_1 and frequency of chlorophyll-deficient mutants in the R_2, diploid rice was more sensitive to γ irradiation of the dry seeds than tetraploid. In the diploid the frequency of chlorophyll-deficient mutants increased linearly with dose. The absence of such mutants from the R_2 of the tetraploid is ascribed to the buffering effect of gene duplication.

2709 MATSUO, T., NAKAJIMA, T. & FUTSUHARA, Y.
(An experiment on seed-selection conditions in rice).
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 113–17. [Japanese].

When the variety Norin 33 [Ministry of Agriculture and Forestry 33] was grown under conditions of N or P deficiency, growth was impeded and maturation accelerated. These effects persisted and were cumulative in later generations grown under deficient conditions and were evident when such progenies were grown under optimum conditions with control plants. One year's growth, however, under optimum conditions sufficed to eliminate these induced changes.

2710 PIACCO, R.
Le prime varietà di riso coltivate in Italia. **(The first varieties of rice cultivated in Italy).**
Riso, Milano 1959 : **8** : No. 12 : 12–14.

The author considers it more probable that rice was introduced to Italy from the orient through Venice than from Spain; this he suggests gave rise to the rice known as Nostrale [Local]; Bertone was introduced from France apparently in the 1820s, on account of its greater resistance to brusone; its name is taken to mean an awnless rice. Chinese was a synonym for Bertone, whereas Chinese Originario was produced by selection from Japanese seed obtained by Sacchi and was introduced in 1903. [Cf. 2714].

2711 DUFOURNET, R. & DOBELMANN, J. P.
Les principales variétés de riz sélectionnées à Madagascar. **(The principal rice varieties selected in Madagascar).**
Riz et Rizic. 1959 : **5** : 73–79.

Brief descriptions are given of ten varieties, Vary Lava 16, Makalioka 34, Fandrampotsy 104, Mahia 118, Makalioka 752, Makalioka 823, Rojofotsy 1285, Riz Rond 1300 [Round rice 1300], Vary Lava Géant 1302 [Giant Vary Lava 1302] and Vary Lava Géant 1303, selected at the Lake Alaotra station, and six varieties, Vary Lava Marovoay 47, Kalila 50, Pièce 56, Ali Combo, Tsipala A and Tsipala M, from the Marovoay station. The breeding programmes were designed to produce high-yielding, locally adapted varieties for the domestic market, and quality products for export. Makalioka 34, Makalioka 823 and Vary Lava 16 are said to be good dual-purpose varieties.

2712 **Recommended upland and lowland rice varieties.**
Tech. Bull. Coll. Agric. Univ. Philipp. College Laguna 1958 : No. 1 : unpaginated.

The bulletin gives illustrated descriptive notes on 14 varieties approved in the Philippines and an identification key.

2713 MATSUO, T., HASEGAWA, K. & YAMADA, T.
(A study of the characteristics of local rices).
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 93–96. [Japanese].

A study was made of grain and panicle characteristics, reaction to KOH and $KClO_3$, photoperiodic behaviour and sexual compatibility

with *indica* rice of 25 local varieties collected in mountainous regions and small islands of Japan. A wide range in all characteristics was observed.

2714 CIFERRI, R.
Lineamenti per una storia del riso in Italia. (Outlines of a history of rice in Italy).
Quad. Ente naz. Risi : undated : No. 8 : Pp. 41.

Literature is cited showing that rice was cultivated in China by 2800 BC; the *Oryza* of the classical Roman authors on the other hand is thought to refer to some other cereal, possibly *Triticum spelta*. In the thirteenth century the grain was apparently imported into Italy but not grown; it was not mentioned by Crescini in 1306 and the first mention of its cultivation in the Milan area is found in a document relating to 1475. The story of its later diffusion into other parts of Italy is traced from contemporary sources. It is generally believed that rice came to Italy from Spain. Data are cited showing that rice was grown in Spain before AD 1150; the information available is insufficient to establish its origin but grounds are presented for believing that it did not come from Egypt.
The first rice forms found in herbaria in Italy were awned and correspond to the type known as Nostrano [Local] or Novarese [Novara rice]. Ostiglia is considered to be a selection of it. The origin of the awnless rices is more uncertain but the writer leans to the view that several awnless introductions were made in the late eighteenth and early nineteenth century and were indiscriminately referred to as Cinese or Chinese and also Bertone, which name was applied also to awnless hybrids from crosses of the local rice with awnless introductions. Many of these came from Carolina but others were from the Philippines, Malabar and Java. The form that finally established itself under the name Cinese or Cinese originario seems to have been one of a number of introductions from the Philippines made in 1893. [Cf. 2710.]

2715 CHANG, T.-D. & HSIEH, S.-C.
Mutations in rice induced by X-rays.
Nung-yeh Yen-chiu/Agric. Res., Taipei 1957 : **7** : No. 4 : 7–15.

The frequency of induced chlorophyll deficiencies among X_1 seedlings bore no relationship to the dosage applied to the germinating seeds. Progenies from semisterile X_1 plants showed continuous or discontinuous variation for this character. Those in the latter category segregated in a 1 : 1 ratio. The semisterility was associated with ring, chain and other types of quadrivalents and was therefore attributed to segmental interchange. A dwarf form three-quarters of the height of the original variety (Taichung 65) behaved as a single recessive mutation.

2716 MORINAGA, T. & KURIYAMA, H.
A note on the cross results of diploid and tetraploid rice plants.
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 187–93.

The authors succeeded in obtaining triploids from $2x$ ♀ x $4x$ ♂, the highest percentage (1·09%) being produced when the flowers were pollinated 24 hr. after hot-water emasculation. Triploidy was confirmed by cytological examination. Maternal plants occasionally arising from the crosses were due to pollen contamination and not to parthenogenesis, as indicated by segregation of the glutinous *v.* nonglutinous condition. No haploid parthenogenesis was detected.

2717 HU, C.-H.
(A comparison between diploid lines obtained from a haploid plant and diploid lines from the original variety. Caryological studies of haploid rice plants. III).
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 135–39. [Japanese].

Diploid lines obtained at Taiwan from spontaneously arising diploid panicles in a haploid plant of Norin 8 [Ministry of Agriculture and Forestry 8] were grown for four generations and compared with diploid plants from foundation seed of the same variety. The two populations showed no significant differences beyond reduced variation in plant height in the progeny of the haploid. A few triploids arose in the later generations of the progenies from the haploid. [Cf. XXIX, 3904].

2718 YATSUYANAGI, S. & TAKEUCHI, T.
(Ecological studies on rice varieties. III. Atmospheric temperature and its effect on the reproductive growth phase).
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1959 : **28** : 164–68. [Japanese].

Data are provided on the critical temperatures for panicle differentiation and heading and the number of accumulated temperature units required during the reproductive phase for six Japanese varieties.

2719 NOGUCHI, Y.
Studies on the control of flower bud formation by temperature and day-length in rice plants.
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 205–11.

Date of heading and number of leaves at time of heading in Japanese varieties with early, medium or late maturity were unaffected by vernalization at 2–5° C. [Cf. XXIX, 3907 and XXX, 1591]. Presowing exposure to high temperature (27°–30° C.) did not appear to have any effect on these two characters in Japanese varieties known to be thermosensitive as regards flower-bud formation.

2720 MATSUBAYASHI, M. & TAKAHASHI, H.
(Some observations on the response of upland rice varieties to high temperature. In particular, on the resistance of varieties to low temperature in the North-East region and the acceleration of heading brought about by high temperature).
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 121–27. [Japanese].

A series of 27 upland and 27 irrigated rice varieties was examined for resistance to low temperature and for heading period under low and high temperatures. In general, upland varieties were more damaged by low temperature than irrigated varieties though they differed considerably in degree of injury. Both upland and irrigated rices vary widely in the extent to which high temperature accelerates heading; in the case of irrigated varieties but not of upland varieties, acceleration in heading is negatively correlated with heading period at high temperature.

2721 SRINIVASAN, V. & BALASUBRAMANIAN, K. M.
Study on evolution of non-shattering strain in rice.
Madras agric. J. 1959 : **46** : 432–34.

As shown by observations at the Agricultural Research Station, Aduturai, Madras, ADT16 gives high yields during the first-crop season but has the defect of considerable shattering. It was therefore crossed with a nonshattering strain, GEB24. Selection against shattering was effected in successive generations by means of a special laboratory apparatus designed by Hanumantha Row. In preliminary trials, two of the cultures thus developed were significantly superior to ADT16 in yield, as well as being about a week earlier in ripening.

2722 SATO, K.
(Studies on the starch in rice tissues. V. On glutinosity).
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1959 : **28** : 28–29. [Japanese].

A comparative study of x, $2x$, $3x$ and $4x$ strains of Saitama glutinous rice and Norin 8 [Ministry of Agriculture and Forestry 8] nonglutinous rice showed that the glutinous strains differed from the nonglutinous in having glutinous starch in the endosperm and pollen but not elsewhere. Degree of polyploidy appeared not to affect type of starch.

2723 NAGAI, T. & MATANO, T.
(Cultivated rice varieties from the viewpoint of root characters. III. On ferruginous films on the roots).
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1959 : **28** : 4–6. [Japanese].

Nine varieties were studied, pertaining to groups I, II and III in respect of root size [cf. XIX, 3910]. Varieties of group I, with the stoutest roots, developed a more copious ferruginous deposit on the roots than varieties of the other two groups. Differences between the groups in seasonal formation of the deposit are also noted.

2724 NAGAI, T. & MATANO, T.
(Cultivated rice varieties from the viewpoint of root characters. IV. The formation of a ferruginous film, root activity and base-exchange capacity).
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1959 : **28** : 208–10. [Japanese].

A comparison of six varieties differing in their capacity to grow in reducing soils revealed a high correlation between cation-exchange capacity and the weight of ferruginous deposit on the roots.

2725 YAMADA, I. & HASEGAWA, H.
(Artificial germination of rice pollen. IX. The effect of different soil temperatures on pollen germination).
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1959 : **28** : 157–59. [Japanese].

The variety Norin 29 [Ministry of Agriculture and Forestry 29] was grown in tanks with the irrigation water at three different temperatures (23, 28 and 33° C.). The germination of the pollen on an artificial medium depended on the temperature of the irrigation water as follows: 28>33>23° C. [Cf. XXIX, 3099].

2726 Sahadevan, P. C.
Studies on the developmental variation of awn in rice.
Curr. Sci. 1959 : **28** : 491–92.

Of 2342 stubbles of the normally awnless variety Co.13, 312 sprouted again and 95 of these flowered, producing heads showing various degrees of awn development. Root pruning of seedlings of the awned varieties Ptb 7, a pure-line selection, and of SR26B was found to restrict awn development. It is suggested that the expression of awning may be influenced by the balance between root and shoot development.

2727 Dewez, J. & Catzeflis, J.
Le riz dans la vallée de la Ruzizi. **(Rice in the Ruzizi valley).**
Bull. INÉAC 1959 : **8** : 341–54.

Seven forms of grain are distinguished among local rice varieties, one grain type predominating in each variety. Selection for improved grain quality is in progress.

2728 Nagato, K. & Ebata, M.
(Studies on white-cored rice grains. II. The physical properties of white-cored rice grain).
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1959 : **28** : 46–50. [Japanese].

Grains of the above sort are characterized by a hard outer layer enclosing a soft porous core. This type of grain occurs with high frequency in varieties used in the preparation of rice wine. Such grains, when steamed, develop cracks through which penetration by the fermenting organism, *Aspergillus oryzae*, is readily effected.

2729 ten Have, H.
De invloed van het tijdstip van de oogst op de kwaliteit van enkele rijstrassen. 2. **(The effect of date of harvest on the quality of some rice varieties. 2.)**
Surinaam. Landb. 1958 : **6** : 201–09.

The percentage of cracked grain was higher at late than at early harvesting dates, but varied from year to year and according to variety.

2730 Takahashi, Y., Iwata, I. & Baba, I.
(Studies on the responsiveness of rice varieties to fertilizer. I. The relations between the varietal responsiveness and nitrogen and carbohydrate metabolism).
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1959 : **28** : 22–24. [Japanese].

A comparative study of three varieties differing in the extent to which they profited from nitrogenous fertilizer showed that ability to respond positively to fertilizer is associated with a lower content of nitrogenous compounds and a higher content of sugar and starch compared with failure to respond or a negative response.

2731 Takeda, T. & Kumura, A.
(Analysis of yield in rice. V. Analysis of responsiveness and irresponsiveness to fertilizer in rice varieties).
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1959 : **28** : 179–83. [Japanese].

A comparative account is given of leaf production, photosynthetic rate and respiration rate in two varieties yielding more heavily with high levels of N fertilizer and two varieties irresponsive to this treatment, one variety in each case being early and the other midseason.

2732 Peiris, J. W. L. & Marks, G. C.
Studies on paddy blast caused by *Piricularia oryzae*. 1. A method of testing varietal resistance to blast.
Trop. Agriculturist 1958 : **114** : 237–44.

Many varieties from different countries were tested for blast reaction in upland nursery beds at Karapincha and Peradeniya, Ceylon, with heavy application of N fertilizer and high relative humidity within the plots as the result of close spacing. Upland conditions were chosen since it is known that silica uptake is inhibited under such conditions and that silica deficiency promotes susceptibility to the pathogen. Grading into seven groups, ranging from very highly resistant to very susceptible, was accomplished on the basis of main type of lesion and leaf area destroyed. A number of varieties proved to be highly resistant.

2733 Padmanabhan, S. Y. & Ganguly, D.
Breeding rice varieties resistant to blast disease caused by *Piricularia oryzae* Cav. I. Selection of resistant varieties from genetic stock.
Proc. Indian Acad. Sci. : Sect. B 1959 : **50** : 289–304.

Details are provided of the standardized techniques employed at the Central Rice Research Institute, Cuttack, India, in subjecting varieties to preliminary screening for reaction to artificial infection with *P. oryzae* at the seedling stage and to subsequent testing for field reaction at the seedling and later stages. On the basis of results from field tests during 1953–56, five varieties were classified as resistant and sixteen as moderately resistant. Varieties in the former group were BJ1, Co.4, S67, SM6 and SM9. A

table indicating the reactions of varieties tested during 1948–55 is included. The resistant and moderately resistant varieties are now undergoing study in other parts of India.

2734 Bui Gui Dap & Ngiem Fu Šuan
(The light phase of some Vietnamese rice varieties).
Agrobiologija (Agrobiology) 1959 : No. 2 : 220–30. [Russian].

Tam Den, Šim Šanh and other varieties with a long growth period required short days for their normal development, while Nam Ninh and most other early varieties flowered in short days and in continuous light.

2735 Miyazato, K.
(The effect of nocturnal water temperature on the growth and root activity of rice seedlings).
Ryukyu Daigaku No Kasei Kogaku Bu Gakujutsu Hokuku/Sci. Bull. Div. Agric. Home Econ. Engng. Univ. Ryukyu. 1958 : No. 5 : 107–15. [Japanese].

A comparative study of six varieties showed that early varieties from more northerly latitudes were more adversely affected by high temperature (35° C.) of the nocturnal irrigation water than late tropical varieties.

FORAGE GRASSES

2736 Thomson, J. R.
Spaced-plant trials of grass varieties in Scotland.
J. Brit. Grassl. Soc. 1959 : **14** : 244–46.

Spaced-plant trials of grass varieties are carried out by the scientific services of the Department of Agriculture for Scotland as a means of preliminary screening. The results for the 58 varieties of *Lolium perenne*, *Phleum pratense* and *Dactylis glomerata* which have now undergone complete trial in this project are summarized, the entries being grouped under maturity classes.

2737 Steppler, H. A.
Application of breeding techniques on red clover, birdsfoot trefoil and timothy.
Rech. agron. Québec 1959 : No. 4 : 15–16. (Abst.).

A note is given of work in progress at Macdonald College of McGill University.

Timothy. Preliminary studies in varietal crosses indicate that a better performance is obtained where one of the parents is chosen from an indigenous strain and one from an introduced strain than when both parental strains are indigenous.

Birdsfoot trefoil. Differences in combining ability in European and Empire strains have made possible an arbitrary classification scheme for grouping clones into three categories as regards combining ability.

Red clover. The detection of differences in the vigour of strains by means of a simple greenhouse test involving the emergence of germinated seeds through a layer of vermiculite is being investigated.

2738 **The Cunningham Laboratory, Brisbane.**
CSIRO, Melbourne 1959 : Pp. 28.

An account is given of the organization and work of the Cunningham Laboratory and its subsidiary institutions in Queensland. Its coordinated programme, directed towards the improvement of pasture production and utilization, includes the introduction and breeding of legumes and grasses.

2739 **Varieties of grasses.**
Frmrs'. Leafl. nat. Inst. agric. Bot. 1960 : No. 16 : unpaginated.

Based on information obtained by the National Institute of Agricultural Botany, United Kingdom, notes are given describing promising varieties of perennial ryegrass, cocksfoot, meadow fescue and timothy.

2740 de Wet, J. M. J
Chromosome numbers and some morphological attributes of various South African grasses.
Amer. J. Bot. 1960 : **47** : 44–49.

Chromosome numbers are reported for 68 species and varieties belonging to 40 genera. Relationships between taxa are considered on the basis of chromosome number and leaf and embryo anatomy. One of the suggestions put forward is that the Oryzeae, Ehrharteae and Centotheceae have a common origin.

2741 de Roo, R.
La sélection polyploïde. **(Polyploid breeding).**
Rev. Agric., Brux. 1959 : **12** : 603–05.

Polyploid lines of perennial ryegrass, red clover, white clover, forage beet and turnips were produced by treatment with colchicine. Encouraging preliminary results suggest that it should be possible by selection to produce good quality tetraploid forage plants. It was found that the reduced fertility which characterized first generation tetraploids could be improved considerably by crossing and reselection.

2742 Patel, A. S.
Studies on the pattern of vegetative growth in populations of *Lolium* and *Phleum*, and its genetic and environmental control.
J. agric. Soc. Univ. Coll. Wales 1959 : **40** : p. 47. (Abst.).

"Regular differences were detected in the rate of leaf and tiller production between strains of ryegrass and timothy grown over a range of sowing dates and in different photoperiods. The effects of seedling density and nitrogen level on leaf and tiller production were also studied.

"Within each strain the rate of leaf appearance was highly heritable, and lines could readily be selected for rapid or slow leaf appearance. This selection produced a negative correlated response in leaf size, and so had no regular effect on total dry matter production."

2743 Glagoleva, T. A.
(Biochemical evaluation of a collection of perennial grasses).
Selekcija i Semenovodstvo (Breeding and Seed-growing) 1959 : No. 2 : 69–70. [Russian].

Biochemical analyses of *Dactylis*, timothy, *Bromus* and *Festuca* forms of different origins at the Institute of Plant Industry showed considerable variability in protein contents. Among the *Dactylis* forms, one from Moldavia and another from the Kabardino-Balkar ASSR were the richest in protein. Early forms of timothy had generally a higher dry-matter content than late forms. Forms of timothy particularly rich in protein comprised both late and early types. The late types originated from Sweden or the region of Gorno-Altajsk and the early ones were found in a natural state in the province of Leningrad. Wild forms of *Bromus* found in Armenia and Leningrad province were much richer in protein than the standard variety in the Leningrad province. A form of *Festuca* from south Sahalin had an appreciably higher protein content than the standard variety for Leningrad.

2744 Clark, K. W. & Mott, G. O.
The dry matter digestion in *vitro* of forage crops.
Canad. J. Pl. Sci. 1960 : **40** : 123–29.

Details are given of an evaluation of an artificial rumen technique as a method of determining dry-matter digestion, using timothy clones [cf. XXVIII, 1356]. It was concluded that the technique shows promise as a means of estimating digestibility of clonal material in forage-crop breeding, provided that certain precautions are taken. All lines to be screened should be included in a single trial to ensure maximum control of variables associated with the technique, and samples should be uniformly processed, preferably freeze-dried, and digested with a single sample of rumen fluid.

2745 Sjøseth, H.
Studies on ice encasement in strains of red clover (*Trifolium pratense*) and timothy (*Phleum pratense*).
Acta agric. Scand. 1959 : **9** : 292–98.

In laboratory tests conducted at Vollebekk, Norway, differences were found between red clover strains in their ability to survive ice encasement for varying periods. Although no clear correlation between tolerance of ice encasement and frost hardiness was detected, the most frost-hardy strains were generally best able to survive under a layer of ice. The strains fell into approximately the same order of survival after being covered with ice in the field. In tests with timothy there was a close correspondence between survival after ice covering, survival in freezing experiments and known winter hardiness. Preliminary hardening increased survival in both timothy and red clover.

2746 Youngner, V. B.
Ecological studies on *Poa annua* in turfgrasses.
J. Brit. Grassl. Soc. 1959 : **14** : 233–37.

This report of investigations at the University of California, Los Angeles, includes information on morphological variation within *P. annua*. Variants may be broadly grouped into two types: (1) distinctly annual, bunching and upright and (2) perennial and prostrate. Preliminary work, it is noted, has indicated that it may be possible to obtain relatively true-breeding selections of the perennial type which would be of some value for turf. Selection for disease tolerance would however be necessary.

2747 **Atomic radiation helps develop better bluegrass.**
Crops & Soils 1960 : **12** : No. 4 : p. 17.

[Cf. 1670].

2748 Grigor' ev, Ju. S.
(On the method of ecological investigations as related to the problem of expediency in the organic world).
Bot. Ž. (Bot. J.), Moskva 1959 : **44** : 1538–45. [Russian].

The adaptational nature of many characters

can only be appreciated in the light of historical data, since their function may have been lost. Thus the high heat requirements of *Bergenia crassifolia* growing today in Siberia are explained by its origin at a time when the area had a warmer climate. *Dactylis glomerata*, though common in humid areas, is resistant to summer drought and is therefore regarded as having originated in some arid area, probably the ancient Mediterranean.

2749 Bradshaw, A. D.
Population differentiation in *Agrostis tenuis* Sibth. II. The incidence and significance of infection by *Epichloe typhina*.
New Phytol. 1959 : **58** : 310–15.

Among 37 populations of *A. tenuis* and *A. stolonifera*, a number showed a high incidence of infection. The infected populations were alike in that in all of them seed production was unimportant and maintenance was almost entirely by vegetative propagation. Populations near to these, in which tall growth and seed production were of importance, contained a much lower proportion of infected plants. Infection prevents inflorescence production and causes an increase in tillering without any other deleterious effects. These observations suggest that infection confers a selective advantage where vegetative reproduction is important and that the host/pathogen relationship may be regarded as a form of symbiosis rather than of parasitism.

2750 Nielsen, E. L. & Smith, D. C.
Evaluation of characters in polycross, inbred, and open-pollination progenies of timothy.
Agron. J. 1960 : **52** : 89–93.

Study of polycross, S_0, S_1 and open-pollinated progenies with respect to vigour, height, reactions to *Puccinia graminis* var. *phlei-pratensis* and *Scolecotrichum graminis* and seed yield suggested that, for strain improvement, extensive reselection of superior plants from large populations from open-pollination might be equally effective and more economical than inbreeding and selection during the initial stages of breeding. When superior plants with such characters as good disease resistance and leafiness have been obtained, selection among inbred plants and lines might be then applied for such a character as combining ability.

2751 Jahn, A.
Cytologische Untersuchungen an künstlichen Artbastarden in der Gattung *Bromus L.* **(Cytological investigations on artificial interspecific hybrids in the genus *Bromus* L.).**
Z. Pflanzenz. 1959 : **42** : 25–50.

These investigations were carried out with the tetraploid hybrid *B. commutatus* x *B. macrostachys* and the reciprocal cross and with the triploid hybrids *B. arvensis* x *B. commutatus* and *B. arvensis* x *B. secalinus*. All hybrids of *B. commutatus* x *B. macrostachys* and the reciprocal cross were very similar morphologically; they showed more luxuriant growth than the parents. Most characters of the hybrid were intermediate between those of the parents but the hairiness of the glumes of *B. macrostachys* was dominant. In *B. arvensis* x *B. commutatus*, the long stem, strong tillering, large overhanging panicles and small coloured spikelets of *B. arvensis* were dominant but many other characters were intermediate in the hybrid. Hybrids of *B. arvensis* x *B. secalinus* were very similar to those of *B. arvensis* x *B. commutatus*.

Diploid *B. arvensis* ($n = 7$) showed completely normal meiosis, having seven bivalents which showed single univalents in a few of the cells examined and some laggards in anaphase I. Quadrivalents occurred in the metaphase I of *B. commutatus* ($n = 14$) in low frequency ($M = 0{\cdot}03$) but anaphase I and anaphase II were normal. In *B. macrostachys* ($n = 14$) more quadrivalents and trivalents were observed. This increase in abnormal chromosome association is accompanied by a decrease in the number of terminal chiasmata; *B. arvensis* had 2 terminal chiasmata per bivalent and *B. macrostachys* had 1·73. Pollen fertility decreased in the same direction. Postmeiotic spiralization of chromosomes was observed in young pollen of *B. secalinus* and *B. macrostachys*; a metaphase-like stage was reached but there were no further developments and a normal mitosis did not occur.

Meiosis in all the hybrids was irregular and led to complete pollen sterility. In meiotic prophase most chromosomes were paired but in metaphase up to 50% of the chromosomes occurred as univalents; chains of 3–7 chromosomes were also observed. Thin regions were noticed between the centromere and the terminal chiasmata in open bivalents and other multivalent chains. About a third of the chromosomes were always laggards in anaphase I and anaphase II; they usually

divided themselves equally into two sets travelling to opposite poles. Both laggards and normal chromosomes frequently showed neocentric movement, the end of one chromosome limb leading in the movement towards the pole. All stages of meiosis were slower in the hybrids than in the parent species. In *B. arvensis* x *B. commutatus*, autosyndetic and allosyndetic pairing were indicated by the chromosome combinations in metaphase I. Trivalents in other hybrids may also have arisen by autoallosyndetic pairing. Many bivalent and univalent bridges were observed in anaphase I and anaphase II of *B. arvensis* x *B. secalinus*.
It is pointed out that although *B. secalinus* and *B. commutatus* are very similar morphologically, they have considerable cytological differences. *B. macrostachys*, *B. commutatus* and *B. secalinus* are thought to have arisen as allotetraploids.

2752 Johnson, H. W.
Reaction of rescuegrass varieties and strains to the head smut fungus.
Plant Dis. Reptr. 1959 : **43** : 1268–69.
Inoculations of seven varieties of *Bromus catharticus* with five collections of *Ustilago bullata* were made at Stoneville, Miss. The variety Lamont showed slight susceptibility to two of these and high resistance to the others. Georgia Selection was resistant to smut from two sources and Nakuru to that from one although neither was heavily infected in any instance.

2753 Cooper, J. P.
Selection and population structure in *Lolium*. II. Genetic control of date of ear emergence.
Heredity 1959 : **13** : 445–59.
In investigations at the Welsh Plant Breeding Station, Aberystwyth, the perennial ryegrass strains Irish and Kent were analysed with respect to the genetic variation in date of ear emergence within the population, heritability of this character and prediction of the advance possible through selection [cf. 1621]. The replicated clones studied represented the original population of each strain and pair crosses and selfings within this population. Most of the variation was genetic and different genotypes maintained the same relative order from year to year. Data on parent-progeny regression and correlation from the pair crosses and selfings indicated that date of ear emergence was highly heritable in both strains but affected by inbreeding depression. Most of the genetic variance was additive and considerable response to selection may be expected. In spite of this high heritability, both strains possessed a considerable degree of heterozygosity for genes controlling date of ear emergence, the mean variance of the progeny from crossing two plants of similar phenotype, or from selfing one being well above the error variance for a single clone. The comparatively small variance of the original populations, not much greater than that within a pair cross, suggested that selection for uniformity of heading in the seed crop is fairly stringent. Methods of estimating genetic variation and heritability in herbage plants are discussed. It is concluded that flowering time in other species also shows mainly additive genetic variance, with little or no dominance.

2754 Cooper, J. P.
Selection and population structure in *Lolium*. III. Selection for date of ear emergence.
Heredity 1959 : **13** : 461–79.
A report is given of a study of the response to selection for date of ear emergence in lines of the perennial-ryegrass strains Irish and Kent resulting from three generations of selection [cf. 2753]. Response to selection continued up to the third generation in all lines, and lines derived from one, two or four initial parents differed little in rate of advance. Kent responded more rapidly than Irish and in both strains the early parental groups responded more rapidly than the late. The advance was asymmetrical in all cases, the shift towards lateness being greater than that towards earliness. By the third generation of selection, the extreme plants from both Irish and Kent were well outside the range of the original populations, and the late lines from Irish corresponded to much of the range of the original Kent while the early lines from Kent corresponded to most of the range of the original Irish. After the third generation of selection, the range between the extremes for earliness and lateness among plants derived from a single individual was greater than that of the original population. A single individual may therefore carry more potential genetic variation than is expressed phenotypically in the original population. Even with close inbreeding, considerable genetic variation was maintained within the lines over the first three cycles of selection. The mating systems employed did not lead to any decrease in developmental stability and the variance between blocks did not undergo any regular change as the result of inbreeding. It is

concluded that present populations of perennial ryegrass are similar in genetic structure to other outbreeding organisms which have been studied in detail, in that most individuals are highly heterozygous and carry a considerable amount of potential genetic variation which can be rapidly released by selection. The comparative uniformity of phenotype with respect to date of ear emergence results from the limiting action of selection rather than absence of genetic variation. The significance of such a population structure in breeding perennial ryegrass is discussed, with particular reference to the optimum number of parents in strain building and the problem of genetic shift during seed multiplication.

2755 AP GRIFFITH, G. & COOPER, J. P.
The normal-acid fibre content of species and varieties of herbage grasses.
J. Brit. Grassl. Soc. 1959 : **14** : 272–76.

The results of an analysis at the Welsh Plant Breeding Station, Aberystwyth, included the finding of genetic differences in normal-acid fibre content in *Lolium perenne*. The genetic control of these differences and possibility of selecting for high or low content if desired are now under investigation.

2756 TARKOWSKI, CZ.
Biologiczne aspekty hodowli traw. (**Biological aspects of grass breeding**).
Postępy Nauk Roln. 1959 : **6** : No. **1** : 13–23.

A study of the natural populations in Poland has shown the existence of a wide range of forms of *Festuca rubra* differing in agronomic qualities; the tallest is var. *planifolia* of ssp. *eu-rubra*, with a height of 81 cm., and the lowest var. *arenaria*, with 55 cm. Differences were observed in height of insertion, length, breadth, colour, position and consistency of the leaves, vars. *arenaria* and *glaucescens* and ssp. *fallax* being distinguished by stiff, upright leaves. The diameter of the tuft was greatest in var. *glaucescens*, where it was 58·5 cm. under contions where in var. *arenaria* it was 31·1 cm.; differences were also detected between biotypes within a botanical variety. Other characters in which differences were observed include type of panicle, 1000-grain weight and awning. The most valuable characters for forage purposes were found in vars. *vulgaris* and *planifolia* of ssp. *eu-rubra*.

The merits of various methods of breeding are discussed. The seed set in isolated panicles varied considerably, from 56·8% in var. *planifolia* to 0·0% in var. *arenaria*; when several inflorescences were enclosed together the sets were increased to 73·3% and 5·5% respectively and open pollination gave 90·6% and 54·8% respectively.

2757 WÖHRMANN, K.
Samenertragsanalyse von di- und tetraploidem Wiesenschwingel (*Festuca pratensis* Huds.) [**The analysis of the seed yield of diploid and tetraploid meadow fescue (*F. pratensis* Huds.)**].
Z. Pflanzenz. 1959 : **42** : 93–102.

Both $2n$ and $4n$ plants showed considerable variation in the number of tillers but on the whole the tetraploids produced fewer tillers. With a favourable sowing time both $2n$ and $4n$ forms produced about the same number of inflorescences expressed as a percentage of the number of tillers but late sowing had an unfavourable effect on inflorescence production in the tetraploids. Diploids produced more spikelets per stem than the tetraploids but the number of flowers per spikelet was similar in both forms. The C_1 plants had an average seed set of 66·3% compared with 67·4% for the diploids and the C_3 plants also had only a slightly lower seed set than the diploids. The 100-grain weight of the C_3 generation was 2·5 g. and that of the diploids was 1·6 g.

2758 RODER, W.
Methodik und Ergebnisse der Prüfung züchterisch wertvoller Einzelpflanzennachkommenschaften von Schafschwingel, *Festuca ovina* L., auf ihre Wurzelleistung bei Drillsaat. (**Methods and results of testing single-plant progenies of breeding value of sheep's fescue, *F. ovina* L., for their rooting performance when sown in drills**).
Z. landw. Vers.-UntersuchWes. 1959 : **5** : 122–31.

In these studies of 200 strains of *F. ovina*, a box-like spade was used by means of which 30 samples could be taken per hour. The values for root weight showed a good distribution around the mean value; there were 36 statistically significant plus and minus deviations. Thus it seems that the procedure will be useful in selecting for good root production. Significant differences were also found in the production of green matter and good correlation was found between root growth and the yield of green matter but the highest values for green matter production were not always obtained from the best root producers.

2759 MACVICAR, R. M.
Note on "Frontier" reed canary grass.
Canad. J. Pl. Sci. 1960 : **40** : p. 203.
Developed at the Central Experimental Farm, Ottawa, Ont., Frontier was licensed in 1959. It is a tall, leafy synthetic, medium in maturity, expected to be more suitable for hay, pasture and silage production than the early, somewhat stemmy varieties now available.

2760 CELARIER, R. P.
Cytotaxonomy of the Andropogoneae. IV. Subtribe Sorgheae.
Cytologia, Tokyo 1959 : **24** : 285–303.
The author recognizes eight genera as belonging to the subtribe Sorgheae: *Lasiorrhachis*, *Sorghum*, *Sorghastrum*, *Vetiveria*, *Chrysopogon*, *Rhaphis*, *Cleistachne* and *Asthenochloa*. A survey is given of cytotaxonomical investigations carried out by himself and other workers on these genera, except *Lasiorrhachis* and *Asthenochola*, which have not been studied cytologically, and *Sorghum*, which has been the subject of an earlier paper [cf. 2698]. A discussion is however given of a recent paper on *Sorghum* by Sharma and Bhattacharjee [cf. XXIX, 1559]. Five is regarded as the most likely basic chromosome number of the subtribe. The only species studied in *Cleistachne C. sorghoides*, has $2n = 36$ and is considered as having $x = 9$. Polyploidy, although of common occurrence, appears to be of less importance than in other subtribes. Marked differences in chromosome size may be observed in different genera and subgenera but their phylogenetic significance is not known. A scheme is given for the possible relationships between the genera and subgenera within the Sorgheae.

2761 FUDULOV, D.
(Maize and sorghum, including sweet sorghum—high-yielding forage plants).
Kooper. Zemed. (Cooper. Fmg.), Sofija 1959 : No. 3 : 35–36. [Bulgarian].
In trials at the Dobrudža Agricultural Institute *Sorghum* cultivars with a short stem were particularly productive, the variety A_2 being superior in this respect to all others.

LEGUMINOUS FORAGE PLANTS

2762 PETROSJAN, S. & BALJAN, G.
(Rainfed lucerne).
Nauk. pered. Opyt sel'sk. Hozjajstv. (Sci. progr. Exp. Agric.) 1959 : No. 3 : 21–22. [Russian].
Several lucerne varieties bred in Azerbaijan yielded more than 100 c. hay per ha. in the 1954–57 trials at Stepanakert. The variety 262 was distinguished by resistance to lodging, pests and diseases; its average yield in 5 years was 101·4 c. per ha.

2763 KEHR, W. R. & GARDNER, C. O.
Genetic variability in Ranger alfalfa.
Agron. J. 1960 : **52** : 41–44.
Forage yield and other agronomic data were obtained from 96 clones randomly selected from the synthetic variety Ranger, and from their polycross progenies.
It is estimated that one third of the total genetic variance is additive and that a yield increase of 9% could be obtained by selecting and recombining the highest yielding 10% of the polycross progenies. Reciprocal recurrent selection is suggested for the exploitation of non-additive genetic effects.

2764 PARADIEV, A. V.
(Lucerne-seed production on the Pahta-Aral state farm).
Selekcija i Semenovodstvo (Breeding and Seed-growing) 1959 : No. 2 : 28–31. [Russian].
This account of seed production on a Kazah farm mentions the lucerne variety S–1–39 introduced from the Cotton Institute. It is earlier and 8–10% more productive than Fergana 700, to which it is also superior in leafiness and resistance to lodging.

2765 TRENTIN, A.
Certificazione del seme di medica e miglioramento degli ecotipi italiani. **(Certification of lucerne seed and improvement of the Italian ecotypes).**
Agricoltura, Roma 1960 : **9** : No. 2 : 47–54.
Numerous factors that can lead to deterioration in lucerne yields are discussed, one of them being the choice of seed. Recent measures taken in Italy to institute a system of seed certification for forage legumes and the scheme recently adopted by the OEEC are referred to and their operation is described.
The typical characteristics of some of the best Italian ecotypes have been lost as a result of contamination with imported types and the genetics institute at Lonigo has since 1952 been carrying out observations on some of them and selecting the most promising plants, which have then been reproduced in isolation. From some 2000 initial plants selected, the best 200 have been retained and combined in groups of 10 for interpollination in isolated plots.

One of the most promising lines so produced, named Leoniceno, is 10–12 days earlier than other lucerne strains, in consequence of which it gives at least one more cut per season; it is also distinguished by rapid development, uniform flowering, large abundant leaves, semierect, succulent stems, good recovery after mowing, resistance to the main diseases and great persistency; it outyields other strains in the second, third and fourth years of growth.

2766 Sinskaja, E. N. & Maleeva, Z. P.
(Ploidy in perennial species of lucerne).
Bot. Ž. (Bot. J.), Moskva 1959 : **44** : 1103–13. [Russian].

Descriptions are given of a number of species, the chromosome numbers of some being reported for the first time. *Medicago borealis* ($2n = 16$ and 18) is now considered to be a distinct species of section *Falcago*. Natural hybrids with *M. sativa* have been found with $2n = 32$ and from them two valuable new varieties have been selected.

Various forms of *M. falcata* have been examined; most contain $2n = 32$ but some have $2n = 32$ and 16 in different cells. The majority of forms are thought to be derived from hybrids with *M. sativa*.

M. romanica subsp. *erecta* ($2n = 17$) is distinguished by drought resistance; no grounds are found for establishing it as a distinct species. *M. quasifalcata* ($2n = 16$) and a form with glandular pubescence and $2n = 32$ are also described. *M. glutinosa* ($2n = 32$) is a valuable fodder plant and is highly resistant to diseases. Natural hybrids with *M. hemicycla* also have $2n = 32$. These and hybrids with other species are thought to be of value for agriculture. *M. hemicycla* ($2n = 16$) forms natural crosses with *M. glutinosa* and plants found in certain areas have cells with $2n = 16$ and 32. Natural hybrids with *M. sativa* have $2n = 32$. *M. coerulea* ($2n = 16$) is drought resistant. It forms natural hybrids with *M. quasifalcata*. *M. trautvetteri* ($2n = 16$) is resistant to heat and drought. *M. dzhawakhetica* ($2n = 16$) is the most winter hardy of the perennial lucernes but the authors have not yet succeeded in crossing it with other species. *M. tianshanica* ($2n = 32$ and 36) is very variable and considered promising for breeding. *M. agropyretorum* ($2n = 32$) forms natural hybrids with *M. tianshanica*. *M. praesativa* ($2n = 32$) grows wild in Transcaucasia. *M. sativa* ($2n = 32$) is a complex species but no diploid forms have been found in it; those reported by other authors are regarded as either hybrids or plants belonging to other species.

The diploid species *M. quasifalcata* overlaps in area with the tetraploid species *M. falcata* and *M. glandulosa* but is able to preserve its identity on account of the chromosome difference. Interspecific hybrids, which occur sporadically, have all proved to be fertile tetraploids; no sterile triploids have been encountered in nature or in seedlings from pollinations with mixed pollen. The most useful seedlings for breeding have been obtained by pollinating a wild diploid species with a mixture of pollen of different species belonging to the complex *M. sativa* s.l. It is pointed out that workers in other countries have only the vaguest ideas about the systematics of this material and what they have used has consisted only of chance specimens; *M. glutinosa* subsp. *polychroa* and its hybrids with *M. sativa* are considered more promising for breeding creeping lucernes than the "diploid forms of *M. falcata*" used so far; forms so described must, it is submitted, be in fact *M. quasifalcata* or some other species, as true *M. falcata* is always tetraploid. Views of foreign workers on the question of origin are also considered naive. The tetraploid cultivated lucernes of Armenia, classed as *M. praesativa*, are regarded as having evolved, under the influence of climatic factors, from the diploid *M. hemicycla* and the existence of diploid forms having all the characteristics of *M. praesativa* is taken as showing that polyploidy is not in itself a decisive factor in speciation. The Asiatic cultivated lucernes are regarded as having evolved from the tetraploid species *M. tianshanica* or *M. agropyretorum*.

The data from Soviet and foreign investigations taken together suggest that the cultivated lucernes are either autopolyploids or segmental allopolyploids.

2767 Jones, A. & Hanson, C. H.
Recovery of the creeping-root habit in F_2 progenies in alfalfa.
Agron. J. 1959 : **51** : 716–18.

Three creeping-rooted plants from Canada were crossed as ♀ parents with Buffalo, Caliverde, African and nine clonal lines selected in North Carolina, all the ♂ parents being upright types. Expression of the creeping-root habit was first noted 10 months after sowing in 170 F_2 families and in cloned creeping parents, the number of shoots originating from root proliferation being determined under field conditions at the Piedmont Research Station, Salisbury, NC. At the age of 16 months, 94% of the plants of the

creeping parents and 2% of the F_2 individuals were creeping. The creeping-rooted segregates exhibited a wide array of growth characteristics. Some tended to resemble the Canadian parents in having procumbent habit, fine stems and narrow leaves, while others were similar to the hay-type parents. Differences between (1) varieties, (2) individual plants within varieties and (3) the North Carolina selections supported the hypothesis of complementary factors suggested by Heinrichs [cf. XXV, 332] as being responsible for the creeping-root habit. The mode of inheritance of this character is however considered to be complex and more information on the effect of inherent vigour on the expression of habit is required. Mean crown width in F_2 families and percentage of creeping plants tended to be correlated. No association was found between number of shoots per plant and crown width in the creeping-rooted F_2 individuals.

2768 Dessureaux, L.
Heritability of tolerance to manganese toxicity in lucerne.
Euphytica, Wageningen 1959 : **8** : 260–65.

Tolerance of manganese, assessed from toxicity symptoms, manganese content of the shoots, reduction in dry weight and reduction in length and breadth of the unifoliate leaf in a 4 x 4 diallel cross grown in two concentrations of manganese, showed high heritability, as estimated from a parent-progeny regression analysis, on the assumption that inheritance follows the autotetraploid model. Genes controlling this character were therefore assumed to be additive and to have low or no dominance. Selection for tolerance should be effective if the selfed-progeny test in the seedling stage is used to identify the most tolerant genotypes.

2769 Weir, J. B.
Investigations on adaptation between strains of the root nodule bacterium, *Rhizobium meliloti* and the host plant, *Medicago sativa* L.
Phyton, Vicente López 1959 : **13** : 163–69.

A strain of *Rh. meliloti* from the Union of South Africa gave a far higher proportion of effective nodules when used as an inoculum for a Southern Rhodesian strain of the lucerne Hairy Peruvian than a strain from the USA or one which, although originating from the USA, had been present in Rhodesian soil for six years. The last mentioned strain showed no evidence of having become adapted to Rhodesian conditions.

2770 Bushong, J. W. & Gerdemann, J. W.
Root rot of alfalfa caused by *Phytophthora cryptogea* in Illinois.
Plant Dis. Reptr. 1959 : **43** : 1178–83.

Five isolates of *Phytophthora* from lucerne in Illinois were compared morphologically and in pathogenicity with *Ph. cryptogea*, from lucerne in California. One of the five differed from the Californian pathogen in both respects; this isolate is only mildly pathogenic on lucerne.

2771 Isaac, I.
***Verticillium* wilt of lucerne.**
NAAS quart. Rev. 1959 : **11** : 75–79.

Under experimental conditions varieties of lucerne found in north Africa (*M. sativa* var. *gaetula*) and some Russian varieties of *M. sativa* have shown some degree of resistance to *V. albo-atrum*; these will be the subject of further testing and breeding.

2772 Howe, W. L. & Pesho, G. R.
Influence of plant age on the survival of alfalfa varieties differing in resistance to the spotted alfalfa aphid.
J. econ. Ent. 1960 : **53** : 142–44.

Lahontan, Moapa, African and Caliverde were exposed at the ages of 3, 14 and 41 days to severe attack by *Therioaphis maculata* for periods of 9, 14 and 21 days in caged plots. Increased age significantly decreased mortality of the resistant varieties Lahontan and Moapa but had no effect on that of the susceptible variety Caliverde, except in the case of the 9-day period. Older plants of African, also a susceptible variety but more tolerant than Caliverde, survived slightly longer than younger seedlings. Very low mortality rates (0–3%) were recorded for Lahontan and Moapa when infested at the age of 41 days. The higher survival of Lahontan and Moapa, despite high aphid populations, indicated that tolerance as well as antibiosis contributed to their over-all resistance.

2773 Pesho, G. R., Lieberman, F. V. & Lehman, W. F.
A biotype of the spotted alfalfa aphid on alfalfa.
J. econ. Ent. 1960 : **53** : 146–50.

Symptoms of susceptibility to *Therioaphis maculata* were observed near El Centro, Calif., during 1958 in the hitherto resistant clone Nevada–1018. This clone had been selected as one of the nine constituting the resistant variety Moapa [cf. XXVIII, 1769]. A biotype (ENT A) capable of reproducing on three of the eight parent clones of Moapa tested was

identified. The biotype did not become established on any of the five parent clones of the resistant synthetic Lahontan. In a cage test of Moapa, ENT A produced much higher populations but caused no increase in plant mortality, compared with a standard biotype. Moapa should suffer little damage from ENT A unless this biotype becomes predominant. Even so, populations on Moapa may be expected to be much smaller than those on susceptible varieties.

2774 Marble, V. L., Meldeen, J. C., Murray, H. C. & Zscheile, F. P.
Studies on free amino acids in the spotted alfalfa aphid, its honeydew, and several alfalfa selections, in relation to aphid resistance.
Agron. J. 1959 : **51** : 740–43.

The lucerne selections analysed in relation to resistance to *Therioaphis maculata* were: I–545, a susceptible clone of California Common; clone C–901, a moderately resistant component of the synthetic Lahontan; and a susceptible selection of Caliverde. Aphids feeding on susceptible lucerne accumulated seven to ten times more β-alanine and ethanolamine than was found in the tissue of the crop, whereas aphids feeding on C–901 contained from none to only a trace of these compounds. No conclusive differences in aminoacid composition were found which distinguished resistant from susceptible plants.

2775 Perttula, O.
Eräiden puna-apilakantojen vertailu. (**A comparison of different red clover varieties**).
Koetoiminta ja Käytäntö 1958 : **15** : p. 36.

The behaviour in SW Finland of the native Finnish strains Tammisto and Jo37 is compared with a Swedish commercial strain, the Russian variety Permin and the Canadian Altaswede. Jo37 has the greatest winter hardiness, followed by Tammisto and Permin. The yield is highest in Tammisto, that of Jo37 being only 1% less.

2776 Steppler, H. A.
Red clover breeding.
Rech. agron. Québec 1959 : No. 4 : 14–15. (Abst.).

The inheritance of growth type and of flower and seed-coat colour was investigated in Dollard red clover, and the conclusions are summarized as follows: (1) The genic effects of growth type in red clover are additive. (2) The growth type is probably controlled by at least 20 gene pairs. (3) White flower is recessive to all flower colours. (4) White flower is always associated with yellow seed coat, but yellow seeds are not only produced by white flowers. (5) There is no evidence to indicate that yellow seed coat is recessive to purple or yellowish-purple seed coat.

2777 Litvinenko, F. P.
(Intervarietal clover crosses).
Selekcija i Semenovodstvo (Breeding and Seed-growing) 1959 : No. 2 : 71–72. [Russian].

Intervarietal hybrids of clover obtained in different ways at Mironovka, Ukraine, outyielded the standard variety Tolmači in the F_1, but heterosis for yield was not maintained in the F_2. The hybrids were obtained by the following methods: (1) restricted open pollination of two varieties; (2) open pollination involving several varieties, and (3) sowing mechanical mixtures of the best varieties for F_1 seed.

2778 Starzycki, S.
Zmienność mieszańców koniczyny białej (*Trifolium repens* L.) z koniczyna czerwoną (*Trifolium pratense* L.). [**Variability of hybrids between white clover (*T. repens* L.) and red clover (*T. pratense* L.)**].
Hodowla Roślin Aklimatyz. Nasiennictwo 1959 : **3** : 277–319.

Grafts were made of various forms of white clover on red clover 'Gloria,' the method of grafting being described. Though the two components flowered at slightly different times it was possible to cross them towards the end of the flowering season. The progeny from uncrossed seed from the two components showed no greater variability than that from ungrafted plants of the two species. Seed from the white clover pollinated from unemasculated flowers of the red clover on which it was grafted was sown in 1953; from 241 seeds sown, 45 seedlings were obtained; they were indistinguishable from the maternal white clover during early growth; three of them failed to flower and the remainder bore white flowers. An F_2 generation was produced from the seed and the individual F_2 plants are described and illustrated. They differed in size, number of leaves, form of plant, inflorescence and flower, seed production and chromosome number. One group of plants showed resemblances to white clover, another to red and a few were intermediate. Various floral anomalies were observed and are described. The chromosome number varied from 30 to 34, there being 2 plants with 30, 3 with 31, 15 with 32 and 1 with 34. One of the plants with $2n =$

32 had pink flowers, a rosette-like growth resembling *T. pratense* and leaf characters resembling *T. repens*.
Some of the F_2 plants were very large, the biggest covering an area of up to 6 m.², and occasional plants were found which exceeded Ladino clover in the number of leaves per unit area; some of these had also a smaller number of inflorescences then Ladino; others had larger leaves than those of Ladino.

2779 **Lakeland red clover performs well in tests.**
Crops & Soils 1960 : **12** : No. 4 : p. 19.
Tested for several years under the name of Wisconsin Synthetic [cf. XXVIII, 611], Lakeland is a high-yielding variety resistant to northern anthracnose and powdery mildew. It is intermediate in maturity and persists through two harvest years.

2780 Lebedeva, V. I.
(Biological characteristics of clover types and methods of detecting them).
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1959 : No. 3 : 125–30. [Russian].
A method for selecting early and late biotypes of red clover from a population based on differences in the time and rate of differentiation of the central and lateral inflorescences under field conditions in early spring is discussed.

2781 Dušečkin, V. I.
(The reasons for failures in breeding clover for winter hardiness).
Selekcija i Semenovodstvo (Breeding and Seed-growing) 1959 : No. 2 : 19–23. [Russian].
Experiments on mixed sowing of a hardy and a nonhardy red clover at Hibiny and Tallin showed that while the hardy variety was better adapted to overwintering, it was suppressed by the other variety which outstripped it in growth and development before the onset of winter. This suppression of the hardy variety was especially noticeable in 15 hr. or shorter days. It is thus concluded that two contrary forces of natural selection are operative which eliminate extreme types of both clover biotypes in hybrid populations.

2782 Graham, J. H., Rhykerd, C. L. & Newton, R. C.
Internal breakdown in crown of red clover.
Plant Dis. Reptr. 1960 : **44** : 59–61.
The red clover variety Lakeland has been found to show a lower incidence of internal breakdown of the crown than Penscott, Dollard and Midland in studies at the US Regional Pasture Research Laboratory, Penn.

2783 Wöhrmann, K. & Meyer zu Drewer, H.
Vergleichende Untersuchungen über die CO_2-Aufnahme di- und tetraploider Pflanzen von *Trifolium incarnatum* in Abhängigkeit von Lichtintensität und Temperatur. **(Comparative investigations on the CO_2 uptake of diploid and tetraploid plants of *T. incarnatum* in relation to the light intensity and temperature).**
Züchter 1959 : **29** : 264–70.
The carbon dioxide uptake of $2n$ and $4n$ plants was found to be almost constant throughout the day after reaching a maximum. The $4n$ plants reached a maximum at 16–18,000 Lux but the CO_2 uptake of the $2n$ plants was still increasing at 20,000 Lux. With optimum illumination, the diploids showed a maximum at 15–20° C. and the tetraploids at about 10° C. At temperatures above 25° C. the $2n$ plants showed a greater decrease in CO_2 uptake than the $4n$ plants. The CO_2 values of the tetraploids calculated relative to leaf volume and fresh or dry weight were almost always below those of the diploids but no marked differences were found in CO_2 uptake relative to leaf area. Individual plants amongst the diploids were more variable than the $4n$ plants.

2784 Milczak, M.
Niektóre zagadnienia hodowli wyki siewnej. **(Some problems of breeding spring vetch).**
Postępy Nauk Roln. 1959 : **6** : 33–42.
In a review of the literature of the subject, reference is made to the author's own crosses between *Vicia sativa* var. *typica*, having green seeds with dark spots and olive-green leaves, and *V. sativa* var. *immaculata*, having light-brown seeds and pink leaves. The hybrid seeds in the reciprocal crosses resembled those of the parent variety; the F_1 plants bore light-brown seeds, some with a few black spots, and the F_2 plants had a wide range of seed types, though pale colours predominated. The leaf colour was mainly intermediate, i.e. pinkish olive in the F_1 and the F_2 segregated into 429 pink : 361 olive : 770 intermediate. The hybrids displayed increases in yield of straw and number of pods and seeds.
An average set of pods of 50% was obtained in crosses in the field, the number of seeds per pod varying from 1 to 7; all seeds germinated. The only cases where no seed was produced were in

crosses of var. *punctata* with vars. *typica* and *immaculata* and the reciprocals, though no differences could be detected in the viability of the pollen or the length of the pollen grains. The complete self fertility of the vetch in Poland was confirmed, the frequent appearance of self-coloured seeds in var. *punctata* being ascribed to the instability of this variety and not to cross pollination; no segregation has been encountered in other characters examined, such as leaf colour or time of maturity, nor in the seed colour in other botanical varieties.
Dark-coloured seeds are usually associated with higher yields and some other correlations of characters reported in the literature are also mentioned.

2785 Borg, Å. & Bingefors, S.
Svalöfs Original Lunavicker. (**The Svalöf original vetch Luna**).
Sverig. Utsädesfören. Tidskr. 1959 : **69** : 333–38.
Selected from Bulgarian material, the new vetch Luna is intermediate between Förädlad söt [Selected Sweet] and Stjärn [Star], giving higher seed yields than the former and showing better vegetative development than the latter. It is later than Stjärn but earlier than Förädlad söt and has seeds the same size as those of Stjärn.

2786 Rowlands, D. G.
A case of mimicry in plants—*Vicia sativa* L. in lentil crops.
Genetica 1959 : **30** : 435–46.
It is argued that the vetch-like contaminant plants which develop in the lentil crop from flattened lentil-like seeds may be regarded as an impurity sown with the crop each year. The contaminant is regarded as a flat-seeded mutant of common vetch and not as a vetch-lentil hybrid.

2787 Lang, R. C. & Gorz, H. J.
Factors affecting embryo development in crosses of *Melilotus officinalis* x *M. alba*.
Agron. J. 1960 : **52** : 71–74.
After preliminary crosses, four plants of Madrid and two of PI178985 were chosen as the *M. officinalis* parents (♀) and four of Spanish (*M. alba*) as the ♂ parents, because of their superior cross fertility. Eleven to 15 days after pollination, the embryos were excised and measured. Highly significant differences in hybrid embryo development were found among the *M. officinalis* plants, embryo length and width being significantly correlated with seed weight of the maternal parent. Larger seed weight in the ♂ parents may also be associated with superior cross compatibility. Using parental plants selected for their cross compatibility on the basis of the information gained on hybrid embryo size, 12 mature interspecific hybrids were obtained without embryo culture. The influence of environmental factors and auxins on embryo development was also investigated. Application of auxins failed to improve embryo development.

2788 Gorinov, A. P.
(Lupin in the Sverdlovsk province).
(Selekcija i Semenovodstvo (Breeding and Seed-growing) 1959 : No. 2 : 53–54. [Russian].
Lupinus angustifolius 'Rozovyj 399' [Pink 399] and 'Benjakonskij 484' were the most productive among the varieties tested as green manures at Kamyšlov. The average yield of green matter of Rozovyj 399 was 237·3 c. per ha. and 16·6 c. seed; the corresponding values for the other variety were 225·2 c. per ha and 14·4 c.

2789 Edwardson, J. R. & Corbett, M. K.
A macromutation in yellow lupine (*Lupinus luteus* L.).
J. Hered. 1959 : **50** : 167–70.
A spontaneous mutant of Weiko III has been classed as a macromutation and named macro–1 mutant. The flowers were aberrant in all their parts, the petioles were without stipules and many of the leaves had funnel-shaped leaflets. Over half of the filaments bore no anthers or only single locules; viable pollen was produced but dehiscence did not occur. The mutant was ♀ sterile. No evidence was obtained that the abnormal phenotype was attributable to virus infection. The mutant was recessive to the normal type in the F_1. Segregates with all the mutant characters together appeared in the F_2 but the population was too small to permit conclusions. It is anticipated that studies of the F_3 and possibly back crosses, as well as of meiosis in the heterozygotes, will lead to an understanding of the origin and inheritance of macro–1.

2790 Tomaszewski, Z. & Kielak, M.
Wstępne badania nad gospodarką wodną roślin strączkowych. (**Preliminary investigations on the water economy of leguminous plants**).
Hodowla Roślin Aklimatyz. Nasiennictwo 1959 : **3** : 527–47.
Preliminary results of studies on transpiration

rate and suction pressure in 15 varieties of yellow lupin, seven of blue lupin and one of white lupin and also in six other leguminous species are presented.

2791 Byszewski, W.
Wpływ wody i światła na wzrost oraz zawartość alkaloidów w łubinie żółtym (*Lupinus luteus* L.). Cz. I. Wpływ wilgotności gleby. [**The influence of water and light on the growth and alkaloid content of yellow lupin (*L. luteus* L.). I. The influence of soil moisture**].
Hodowla Roślin Aklimatyz. Nasiennictwo 1959 : **3** : 440–64.

In comparisons of a nonbitter and a bitter variety, the latter was more resistant to the deleterious effects of low soil moisture. With decreasing soil moisture, each variety showed an increase in alkaloid percentage in the dry matter of the roots, stems and seeds, the increase being greater in the bitter variety. No clear relationship between protein content and alkaloid content was detected. Numbers of aphids on the leaves were higher in plants with a high water content.

2792 Byszewski, W.
Badania nad zawartością wody w liściach różnych odmian łubinu żółtego (*Lupinus luteus* L.). [**Studies on the water content of the leaves of different varieties of yellow lupin (*L. luteus* L.)**].
Hodowla Roślin Aklimatyz. Nasiennictwo 1959 : **3** : 465–74.

Varietal differences in water content of the leaves have been found among 11 yellow lupins, the determinations being made at 9 a.m. and 2 p.m. On dates a month apart, however, the intervarietal differences were smaller than those between the values on the different dates. There was a positive relation between water content on the one hand and yield of green matter and seeds on the other.

2793 Byszewski, W.
Alkaloidy łubinowe. (**Lupin alkaloids**).
Hodowla Roślin Aklimatyz. Nasiennictwo 1957 : **1** : 327–73.

This review on the occurrence of alkaloids in lupin and their relation to developmental stages and physiological and morphological characteristics includes a short section on the inheritance of alkaloids.

2794 Przybylska, J.
Free arginine in bitter and nonbitter seeds of blue and white lupine.
Bull. Acad. polon. Sci. : Sér. Sci. Biol. 1959 : **7** : 359–62.

In chromatographic studies of the free aminoacids present in seeds of four blue varieties, of which two were bitter, and three white varieties, one of which was bitter, evidence of a negative relation between the contents of free arginine and alkaloids was obtained.

2795 Bachmanowa, S. & Byszewski, W.
Wpływ nawadniań wzbogaconych ściekami na wzrost i skład chemiczny łubinów żółtych. (**The influence of irrigation enriched with sewage upon the growth and chemical composition of yellow lupins**).
Hodowla Roślin Aklimatyz. Nasiennictwo 1959 : **3** : 475–89.

Differences in reaction to irrigation, sowing date, and fertilizer treatment have been observed between a sweet and a bitter variety, the former giving higher yields and showing a greater response to fertilizers.

2796 Fedorov, M. V. & Svityč, K. A.
(**The efficacy of different strains of nodular bacteria in symbiosis with different varieties of lupin**).
Izv. timirjazev. sel'skohozjajstv. Akad. (News Timirjazev agric. Acad.) 1959 : No. 6 : 39–44. [Russian].

Experiments on inoculation of lupins with different strains of nodule bacteria showed that each variety had its own strain; this was apparent from different amounts of nodules formed on the roots and the resulting yield increments.

2797 Takasugi, K. & Futatsudera, T.
(**Studies on the induction of tetraploid *Astragalus sinicus* and on changing its usefulness**).
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 145–53. [Japanese].

Colchicine-induced tetraploids of this species excel the diploids in green-matter yield by 30% and are also superior in content of N, P and protein. However, they grow more slowly, are relatively infertile and produce more hard seeds. The most frequent chromosome configurations are $4_{IV} + 8_{II}$, $4_{IV} + 7_{II} + 2_{I}$, $5_{IV} + 6_{II}$ and $6_{IV} + 4_{II}$. Crosses between $2x$ and $4x$ strains gave a poor set, the chromosome numbers of

the progenies varying from $2x$ to $4x + 1$. Three improved $4x$ strains are described: 14–8–1, 8–2–1 and 1103.

2798 Pecket, R. C.
The constituents of leaf extracts in the genus *Lathyrus* and their bearing on taxonomy.
New Phytol. 1959 : **58** : 182–87.
Leaf extracts of 28 species were analysed by means of chromatograms. Two flavonols and two coumaric acids were of frequent occurrence. Species considered to be closely related on the basis of morphology, cytology and genetics had similar complements of these substances. Resemblances among *L. hirsutus*, *L. pratensis*, *L. palustris* and *L. maritimus* in constitution of the extracts provided support for those classifications in which these four species are assigned to sect. *Eulathyrus*. Since leucoanthocyanins were found only in *L. pratensis*, support was also obtained for the view that these substances are generally absent in leaves of members of the Vicieae.

2799 Dilhac, P., Busson, F. & Georgin, A.
Note sur l'étude chimique des graines de *Voandzeia subterranea* (Thouars). (**A note on the chemical study of seeds of *V. subterranea* Thouars**).
Riz et Rizic. 1959 : **5** : p. 120.
The aminoacid content was measured in seeds of six varieties of *V. subterranea*, one from the Camaroons and five from Madagascar. No significant varietal differences were found from the standpoint of nutrition.

ROOTS AND TUBERS

2800 Forsøg med stammer af foderbeder. (**Trials of strains of fodder beets**).
Tidsskr. Frøavl 1960 : **24** : 318–21.
Data on yields of tops, roots and dry matter are given for three mangels, ten sugar mangels and two sugar beets for fodder tested in 1956–59 at 11 localities in Denmark. Notes on the individual strains are also provided.

2801 Voederbieten, 1960. (**Mangels, 1960**).
Landbouwvoorlichting 1960 : **17** : Bijl. 65; Ber. Rassenkeuze No. 282 : Pp. 6.
Data on the yield, bolting resistance, dry matter content and other characters are presented for 55 varieties tested in the Netherlands during 1956–59.

2802 Nicolau, A. & Dornescu, A.
Culturi comparative cu soiuri de sfeclă de nutreţ. (**Comparative trials of mangel varieties**).
Stud. Cercet. şti., Biol. Şti. agric. Iaşi 1958 : **9** : 157–60.
In this trial of mangels and half sugar beets at the Tîrgu Frumos research station during 1954–56, the highest yield and highest dry-matter production/ha. were obtained from Rozsaszinübeta [Pink beet] though its percentage dry matter was low.

2803 Swailes, G. E.
Resistance in rutabagas to the cabbage maggot, *Hylemyia brassicae* (Bouché) (Diptera: Anthomyiidae).
Canad. Ent. 1959 : **91** : 700–03.
In studies conducted at Lethbridge, Ala., over the period 1955–1958, consistent differences in amount of damage and number of puparia were found between varieties; also, significantly higher numbers of eggs were laid on certain varieties. Wilhelmsburger was resistant to establishment and development of the larvae and Laurentian appeared to have some resistance both to the larvae and to oviposition.

2804 Plaisted, R. L. & Peterson, L. C.
A technique for evaluating the ability of selections to yield consistently in different locations or seasons.
Amer. Potato J. 1959 : **36** : 381–85.
This paper has already been summarized from another source [cf. 522].

2805 Raddatz, E.
110 Jahre Deutsche Kartoffelzüchtung. Entwicklung, Erfolge und Zukunftsaufgaben. (**110 years of German potato breeding. Development, successes and future tasks**).
Kartoffelbau 1959 : **10** : 185–86.
A general and brief account of potato breeding in Germany is given.

2806 Schober, K.
Kartoffelzüchtung in der Tschechoslowakischen Republik. (**Potato breeding in the Czechoslovakian Republic**).
Bodenkultur 1959 : **10** : 287–90.
In this brief account, mention is made of some of the work being carried out at the major breeding stations in Czechoslovakia.

2807 Nye potetsorter i forsøk på Jæren. (**New potatoes in trials at Jæren**).
Bondevennen 1959 : **62** : p. 811.
Among varieties which have shown promise at

Jæren and other Norwegian localities are the industrial potatoes Urtica, Wohltmann x Ås and Pimpernel, the last two of which may also be used as table varieties.

2808 Aardappels, 1960 (Observatieproefvelden). [**Potatoes, 1960 (Observation trial fields)**].
Landbouwvoorlichting 1960 : **17** : Bijl. 66; Ber. Rassenkeuze No. 283 : Pp. 4.
Yield data and descriptive notes are presented for 35 varieties tested on different soil types in the Netherlands. Fifteen of the varieties are unnamed and still in the preliminary testing stage.

2809 Aardappels, 1960 (Interprovinciale proefvelden). [**Potatoes, 1960 (Interprovincial trial fields)**].
Landbouwvoorlichting 1960 : **17** : Bijl. 67; Ber. Rassenkeuze No. 284 : Pp. 7.
Notes and data on the yield and quality of some 50 potato varieties tested on different soil types in the Netherlands are given, arranged under the headings: table potatoes, fodder potatoes, industrial potatoes and export potatoes.

2810 Atanasov, S.
(What potato varieties should we grow?)
Kooper. Zemed. (Cooper, Fmg.), Sofija 1959 : No. 2 : 34–37. [Bulgarian].
Brief descriptions of varieties recommended on the basis of Bulgarian trials are given. They include: a new late Bulgarian cultivar 729 (Aquila x Flora) which has superior flavour to Aquila; the midseason Mirka [Measure]; and the early hybrid 6/39. The first two show improved resistance to *Phytophthora* and other diseases by comparison with Bintje and Early Rose. All the varieties produce uniform tubers rich in starch and their cooking quality and flavour are good. The best fodder varieties were Universal and Borka which were suitable for combine harvesting and were rich in protein and vitamin C and had a starch content of the order of 19%.

2811 Robinson, R. G.
20 years of potato breeding. Part II.
Potato J., Christchurch, NZ 1959 : 1–5.
Tabulated information is given on trials of South American seedlings grown in New Zealand. Most of these seedlings were discarded for various reasons. It has not yet been possible to breed frost-resistant varieties.
A large number of crossings were made between local and imported commercial varieties. Glen Ilam, bred from Catriona and Chippewa, and Ilam Hardy, bred from Arran Pilot and Chippewa, are two promising varieties now being widely grown in New Zealand. [Cf. XXIX, 2794].

The National Potato-Breeding Program, 1958.
US Dep. Agric. 1959 : Pp, 293. (Mimeographed).
Contributions dealing solely with yield trials of seedlings and varieties are here omitted. Seedlings which have reached the status of commercial release however, are noted.

2812 *Akeley, R. V.* et al. *Plant Industry Station (Beltsville, Md.) and Chapman and Aroostook farms (Presque Isle, Maine).* (*pp. 1–15*).
Tabulated information is presented on yield and quality trials conducted at three stations. Of 27 new selections tested for scab resistance at the Aroostook Farm 12 were rated highly resistant.

2813 *Schark, A. E., Akeley, R. V. & Bonde, R. Variety test in wilt-infected soil.* (*p. 16*).
Of twelve selections tested for resistance to *Verticillium* wilt at Caribou, Maine, varieties 41956, 792–94, Ontario and 50B9–8 were the most resistant. The relatively low yield of 50B9–8 is attributed to poor germination due to wet weather. While Ontario gave the highest yield, 792–94 and 41956 gave the highest dry-matter content.

2814 *Varietal reaction to net necrosis and stem-end browning.* (*p. 17*).
Yield and tuber symptoms are recorded for net necrosis and stem-end browning in nine varieties exposed to leaf-roll infected Katahdin plants. B2368–4, B2187–25, Boone and 50B9–8 were completely free of symptoms, and B2368–4 gave the highest yield.

2815 *Buck, R. W. (Jun.) & O'Brien, M. J. Late blight resistance.* (*p. 19*).
A total of 6548 seedlings from 26 crosses and 3 selfed lines were inoculated with 200 spores of race 0 of *Phytophthora infestans.* One or both of the parents were immune from one or more races. A survival percentage of 83·7 was obtained.

2816 *Akeley, R. V., Peterson, L. C. & Schark, A. E. Golden nematode resistance.* (*pp. 19–20*).
Tabulated information is presented on the response of a number of new selections to golden-nematode infection. Twenty-four resistant selections were isolated.

2817 *Buck, R. W.* (*Jun.*). Solanum *species and hybrids.* (*pp. 22–23*).

Investigations of crossability among diploid species were continued in 1958. From a total of 586 interspecific combinations attempted, seed was obtained from 246. Cytological studies showed normal chromosome pairing at diacinesis and metaphase I with usually 12 bivalents in each cell. Occasional hybrids were observed with bridges and fragments at anaphase I.

Attempts were made to self and to cross with *S. tuberosum* several artificial tetraploids of diploid species and hybrids. Of 29 selfed clones, 23 set seed. In crosses with Katahdin, 18 of 34 clones set seed, and with Menominee 26 of 44 clones set seed. Cytoplasmic control is suggested for male sterility in diploid hybrids involving certain clones of *S. verrucosum* as the female parent.

2818 *Webb, R. E.* et al. *Potato disease investigations.* (*pp. 23–37*).

Seedling screening for resistance to late blight and to viruses A, X and Y under field and greenhouse conditions was continued.

2819 *Hougas, R. W. & Ross, R. W. Inter-regional potato introduction project.* (*pp. 38–39*).

The screening of stocks in the Inter-Regional Collection for resistance to viruses A and X, leaf roll and spindle-tuber viruses and *Verticillium* wilt was continued. The use of haploid ($2n = 24$) strains of *S. tuberosum* in gene-transfer studies is mentioned.

2820 *Hougas, R. W. & Peloquin, S. J. Genetics and cytogenetics of the tuber-bearing* Solanum *species.* (*pp. 40–41*).

The 29 haploid plants ($2n = 24$) of *S. tuberosum* obtained during 1957 have been propagated and tested for crossability. Twenty of the haploids flowered and, of these, 19 were successfully used as female parents in intrahaploid crosses or in matings with other tuber-bearing diploid *Solanum* species. Two haploids were highly male fertile.

F_1 populations from 88 combinations and F_2 and BC_1 populations from five combinations were obtained. Since the pollinator is known to affect the frequency of haploidy in other plants, a search for efficient haploid-inducers has been initiated.

2821 *Kehr, A. E. North central regional trials 1958.* (*pp. 42–52*).

The introduction Neb. 82–49–IX has been released as Excel. Tabulated information is given on yield, maturity, total solids, scab resistance and external and internal defects of 18 varieties grown in ten areas. The most outstanding selection for scab resistance was Ag. 29, which matures at the same time as Cobbler and Triumph.

2822 *Bienz, D. R. Pacific northwest.* (*pp. 53–61*).

More than 650 selections were rated for resistance to various diseases. Complete recovery from early-season leaf-roll symptoms was noted in PI205623, PI1222943 and PI214374, while seedling B2759–5 has remained free from symptoms for four years. A170–9 is a promising *Verticillium* wilt-resistant selection.

2823 *Dykstra, T. P. Southern project.* (*pp. 62–68*).

Testing of selections for yield and for reaction to scab and late blight is reported. A high percentage of blight-resistant seedlings was obtained.

2824 *McLean, J. G., Chapman, H. A. & Schaal, L. A. U.S. - Colorado potato field station (Greeley, Colorado).* (*pp. 69–77*).

In a seedling plot badly infected by leaf roll, mosaic, Y virus, yellows, necrosis and spindle-tuber virus, one line, CS16055, appeared to be completely free of symptoms. In tuber-quality trials the lowest percentage of defects was shown by Colorado seedlings 11888, 11889 and 13178. CS12240 shows promise as a high-yielding, scab-resistant selection. CS13178 has been released as Navajo [cf. XXIX, 4030]. Of 156 seedling selections replanted in scab-infected soil, 99 were rated highly resistant.

2825 *Dearborn, C. H. Alaska.* (*pp. 78–79*).

Two introduced, red-skinned varieties, Red Beauty from Wisconsin and Norland from North Dakota, have proved highly adaptable to Alaskan growing conditions. Screening stocks for frost resistance was continued in 1958 and two selections are now being studied. Preliminary notice is given of a new variety tested under the code number Alaska 43–47–10–50. It is recommended primarily for domestic cultivation.

2826 *Davis, G. N. California.* (*pp. 80–81*).

In scab-resistance trials conducted at Shafter, Calif., selection A180–25 yielded the highest percentage (79·2%) of marketable tubers.

2827 *Eddins, A. H. Florida.* (*p. 92*).

Tubers of four varieties, Boone, Delus, Plymouth and Pungo, and of selections B294–65 and B606–3 showed no symptoms of corky ring-spot disease when grown in infested soil.

2828 *McCubbin, E. N. & Eddins, A. H. Potato variety and seedling selection trials in* 1958. (*pp. 93–95*).
Selection B2368–4 recovered from frost damage and produced 1 lb. of potatoes per hill at Hastings, Fla. Selection B355–35 and the varieties Merrimack, Delus and Saco also recovered to produce more than ¾ lb. per hill. These trials are being continued.

2829 *Scudder, W. C. Florida* (*Sanford*). (*p. 97*).
Of 18 stocks grown at Sanford, Fla., Red LaSoda obtained from Nebraska received the highest rating for production of US No. 1 tubers and was also the only variety free from heat sprouting at harvest time. However a second stock of this variety obtained from the USDA gave a rather poor performance.

2830 *Iritani, W. M. & Bienz, D. R. Idaho* (*Aberdeen*). (*p. 100*).
Two selections, Ia 1410–1 and B4170–3, were entirely free of scab when grown in infested soil. Ia 1410–1 is a high-yielding selection, resistant to late blight and high in solids content. It matures slightly later than Cobbler. B4170–3 is resistant to *Verticillium* wilt.
Katahdin, OB3596–1 and B3131–8 are suggested as sources of resistance to insect attack. No correlation was found between resistance to leaf-roll virus (aphid vector) and resistance to flea beetle and leaf hopper.

2831 *Miller, J. C. Louisiana.* (*pp. 117–22*).
Seedlings selected during 1956 and 1957 are evaluated for total solids, dry matter, yield and resistance to late blight and common scab. Seedling 71–68 had a specific gravity of 1·089 and dry-matter content of 21·86, both values being significantly higher than any of the standard varieties tested. Seedlings 42–45, 62–162, 91–78 and 91–143 show promise. The last three are highly resistant to blight and all four seedlings have shown some resistance to scab. Seedling 42–45 outyielded Red LaSoda in 1957 and 1958. A new technique for checking pollen viability is noted.

2832 *Bonde, R., Akeley, R. V. & Merriam, D. Maine.* (*p. 123*).
Two ring-rot-resistant seedlings, B3478–45 and B3478–50, gave slightly higher yields than Kennebec, Green Mountain, Teton and Katahdin.

2833 *Simpson, G. W., Bonde, R., Manzer, F. E., Akeley, R. V. & Merriam, D. Maine.* (*pp. 129–32*).
Field testing for leaf-roll resistance was continued in 1958. The reactions of progenies of different crosses and selfed lines to infection are tabulated.

2834 *Thompson, N. R., Isleib, D. R., Wheeler, E. J. & Hooker, W. J. Michigan.* (*pp. 139–41*).
Screening of seedlings for resistance to leaf roll, late blight and scab was continued in 1958. Of 292 leaf-roll-resistant clones, 43 highly resistant lines were retained for further testing.

2835 *Lauer, F. I., Blomquist, A., Eide, C. J. & Knutson, K. Minnesota.* (*pp. 142–47*).
A number of clones without immunity genes (RO) were tested for field resistance to late blight. Selfed progeny of three RO parents, low to medium in resistance, showed a segregation range sufficiently wide for effective selection for increased resistance. In each progeny, segregates were obtained with greater resistance than that possessed by Red Pontiac, and most of these were also scab resistant. No relation was found between resistance to common and russet scab. The reaction of 26 USDA selections to infection by common scab is reported. Selections B4090–5, B4105–2, B4132–25 and B4207–1 showed no symptoms.

2836 *Turnquist, O. C. Minnesota.* (*pp. 148–51*).
The performance of named varieties in the 1958 variety demonstrations is reported together with notes on some of the newer varieties used. These are: Plymouth [cf. XXVII, 1935], Redbake [cf. XXVIII, 658], Huron [cf. XXVIII, 1297], Antigo [cf. XXVI, 2592], Norland [cf. XXIX, 477] and Tawa [cf. XXX, 530].

2837 *Werner, H. O. & O'Keefe, R. B. Nebraska.* (*pp. 152–77*).
Notes are given describing advanced red and white-skinned selections which are scab and heat resistant. Seedling 156.48–2X is to be released for commercial production under the name Bounty.
Nebraska line 59.41–P_1 (Hindenburg x Colorado 1485R) is a common source of resistance in many of the more outstanding scab-resistant selections.

2838 *Peterson, L. C. & Plaisted, R. L. New York.* (*pp. 193–95*).
Solanum andigenum has been used as a source of resistance to golden nematode in crosses with *S. tuberosum*. Roughly half the progeny was found to be resistant and this proportion was maintained in back-cross generations.

2839 *Johansen, R., Benson, A. P., Lana, E. P. & Cotrufo, C. North Dakota.* (*pp. 201–17*).
Seven selections showing high resistance to

common scab and moderate resistance to russet scab are listed. Three promising seedlings, ND3324–2, ND3815–1 and ND3980–5, proved resistant to virus Y, and a number of virus-X-resistant selections made in 1957 have maintained their immunity.

2840 *Sleesman, J. P. Ohio.* (*pp. 220–22*).
Late-maturing varieties were generally more resistant to potato leaf hopper and flea beetle than were early varieties.

2841 *Grun, P. & Krum, M. Pennsylvania.* (*pp. 223–24*).
It was reported previously [cf. XXVIII, 664] that germination percentage was higher within diploid species of the section *Commersoniana* than within *Tuberosa* or in *Tuberosa* x *Commersoniana* hybrids. Repeat tests, however, have failed to confirm this, seed of all combinations showing over 90% germination. The putative *S. polyadenium* x *S. macolae* hybrids were found to be of pure *S. polyadenium* stock, so that all attempts to cross the latter with other species have failed.
A characteristic type of male sterility was found to occur in crosses involving *S. verrucosum* (section *Demissa*) with species from *Tuberosa* and *Commersoniana*. *S. verrucosum* can be crossed with *Tuberosa* species only if it is used as the female parent. This also applies in crossings with *Commersoniana* species except in the case of *S. chacoense* where *S. verrucosum* can be used successfully as the male parent. When used as a female parent the hybrids are usually male sterile.

2842 *Locke, S. B. Washington.* (*pp. 259–62*).
Of 1914 seedlings tested for leaf-roll resistance in 1955, six have survived four years' field exposure to the disease. Four of these have the resistant selection X1276–185 as a common ancestor, while each of the other two has the resistant B24–58 as one parent.

2843 *Gallegly, M. E. West Virginia.* (*pp. 263–65*).
In breeding for resistance to late blight, clones carrying a new dominant gene derived from *S. demissum* and designated *Rx* have been back crossed to selections and varieties of *S. tuberosum*.

2844 *Westover, K. C. & Shumaker, J. R. West Virginia.* (*pp. 266–68*).
Seedling screening for resistance to drought, scab, *Verticillium* wilt, wart disease, yellow dwarf, leaf roll, net necrosis, ring rot and viruses A, X and Y is reported.

2845 *Johnston, G. R., Rowberry, R. G. & Parks, N. M. Canada* (*Ontario*). (*pp. 282–90*).
Adaptation trials of seedlings and varieties introduced from the USA are reported. Introductions are rated for resistance to scab, late blight, *Rhizoctonia* and silver scurf. Out of a total of 110 introductions, 73 are being retained for further testing.

2846 *van der Plank, J. E. South Africa* (*Pretoria*). (*p. 293*).
Of the leaf-roll-resistant seedlings introduced from the USA, B24–58, B24–78 and X1276–185 have been widely used in breeding programmes in South Africa. Seedlings X927–3 and B936–12, however, became infected under field conditions here.

2847 Pandey, K. K.
Self-incompatibility system in two Mexican species of *Solanum*.
Nature, Lond, 1960 : **185** : 483–84.
The South American species *S. megistacrolobum* has been found to have a one-locus, multiallelic, gametophytic system of self incompatibility similar to that reported by Pal and Nath for *S. chacoense* [cf. XII, 684], whereas the two Mexican species *S. ehrenbergii* and *S. pinnatisectum* possess a two-locus system which is described as follows. "The genetics of incompatibility is controlled by two independently segregating loci each with a series of multiple alleles. Pollen determination is gametophytic and there may be individual action or epistasis between the alleles of the two series. In the style there is individual action of *S* alleles. A pollen grain is incompatible on a style when either one or both of its two alleles (of two different series) are also present in that style." This system may prove to be of general occurrence in the Mexican species and restricted to them. In contrast, the one-locus system is probably confined to South American species. It also seems justifiable to assume that the two-locus system was able to evolve in the Mexican diploid tuberous *Solanum* spp. because of their geographical isolation. If the present basic number of $x = 12$ in a large proportion of members of the Solanaceae has been derived by doubling of the original basic number of $x = 6$ at a very early stage in the evolution of the family, the two *S* loci in the Mexican species of *Solanum* may be regarded as being the result of duplication of the original *S* gene. The possibility that segmental interchange brought about duplication of the *S* locus cannot however be ruled out. Whatever the origin of the two *S* loci,

initially they must have caused self compatibility as the result of competitive interaction between the *S* alleles in the pollen. It is suggested that self incompatibility was restored in the South American species by selection for loss of function of one of the *S* loci and in the Mexican by selection against competition between *S* alleles in the pollen. The absence of competition in the diploid pollen of *Physalis ixocarpa*, a native of Mexico and Central America, appears to support this hypothesis [cf. XXVIII, 2592]. The reason why the Mexican group of *Solanum* spp. should have evolved differently from the South American as regards control of self incompatibility is however not clear.

2848 HARBORNE, J. B.
Plant polyphenols. 1. Anthocyanin production in the cultivated potato.
Biochem. J. 1960 : **74** : 262–69.

The results of an analysis of anthocyanins in cultivated diploids and tetraploids at the John Innes Horticultural Institution, England, are reported. Ten anthocyanins were found in the tubers or flowers. Six were identified as the p-coumaryl 5-glucoside 3-rhamnosylglucoside derivatives of pelargonidin, cyanidin, peonidin, delphinidin, petunidin and malvidin and the remaining four as the 3-rhamnosylglucosides of pelargonidin, cyanidin, delphinidin and petunidin. The distribution of these pigments in six genotypes in *Solanum phureja* is described. The mode of inheritance of anthocyanin production in cultivated potatoes is considered to be as follows. *P* and *R* both determine the type of anthocyanidin formed, *P* controlling delphinidin production in both flower and tuber and *R* synthesis of cyanidin in the flower and of pelargonidin in the tuber. *R* is epistatic to *P* in the tuber so that its effect on pigmentation is only apparent in *pp* genotypes. No recessive *rr* form is known, the only other allele of *R* discovered being R^{pw}. A third gene, *Ac*, is concerned, not only with acylation, but also with the attachment of a glucose residue in the 5-position and with the methylation of delphinidin and cyanidin derivatives. *Ac* is however not completely effective in its control either of acylation or methylation. Thus, in flowers of *AcAc* genotypes about half the cyanidin produced is unacylated. Control of methylation by *Ac* is complete in the flowers but incomplete in the tubers, where the 3-rhamnosylglucoside of petunidin, the monomethyl ether of delphinidin, is found in *PPacac* genotypes. Although the present work has confirmed the finding of Dodds and Long [cf. XXV, 2150] that the anthocyanins in tetraploid cultivated potatoes are generally similar to those in diploids, two main differences have been noted between *S. tuberosum* and ssp. *andigenum* on the one hand and diploids on the other. Negretein was found only in the tetraploids, while the production of peonanin is considerably diminished or absent in red and blue tetraploids. The flavonols myricetin, quercetin and kampferol were detected in flowers of *S. phureja*, the production of myricetin being under the control of *P.*

2849 HARBORNE, J. P.
Plant polyphenols. 2. The coumarins of *Solanum pinnatisectum.*
Biochem. J. 1960 : **74** : 270–73.

Three coumarins, esculin, cichoriin and scopolin, were found in flowers of *S. pinnatisectum.* The other major polyphenols in this species were also identified. Only two other tuberous *Solanum* species, *S. jamesii* and *S. sambucinum*, contain coumarins in their flowers. Coumarin production may thus be provisionally considered as being characteristic of the series *Pinnatisecta.*

2850 LAUER, F. I.
Recovery of recurrent parent characters from crosses of *Solanum demissum* x *S. tuberosum* in successive backcrosses.
Amer. Potato J. 1959 : **36** : 345–57.

The F_1, BC_1, BC_2 and BC_3 progenies of two crosses of *S. demissum* x *S. tuberosum* and the selfed progenies of the parents were grown together; S_1 and S_3 clones of *S. tuberosum* were used as recurrent parents. In the cross involving the S_3 parent, the means of the F_1 foliage characters were on the whole higher than those of the selfed progenies of either parent. The F_1 means for tuber characters were similar to those of *S. demissum.* The mean values in successive back crosses changed towards those of the recurrent parent and were very close to them in the BC_3. In the cross of the S_0 parent, the F_1 means for foliage and tuber characters were generally equal to or lower than those of selfed progenies of either parent, and the means of the BC_2 and BC_3 progenies were very similar to those of the recurrent parent. The differences between selfed progenies of the *S. tuberosum* parents were also found in their respective BC_3 progenies. From these results it appears that characters of *S. tuberosum* recurrent parents may be closely approached in the BC_3 generation in the absence of selection.

2851 KAWAKAMI, K. & MATSUBAYASHI, M.
Studies on the species differentiation in the section Tuberarium of Solanum. VI. Meiotic behavior of amphiploids from *Solanum longipedicellatum* x *S. chacoense* and its bearing on genomic affinity between the parent species.
Hyogo Noko Daigaku Kenkyu Hokoku : Nogaku Hen/Sci. Rep. Hyogo Univ. Agric. : Ser. Agric. 1958 : **3** : 124–30.

The amphidiploid of *S. longipedicellatum* x *S. chacoense* had a high frequency of multivalents at metaphase I, the mean numbers being $3_{IV} + 3_{III}$ per cell. Later stages of meiosis showed various irregularities, such as laggards at anaphase I and II, unbalanced plates at metaphase II and micronuclei. Only 24% of the pollen grains were stainable. It is suggested that the genome of *S. chacoense* is completely homologous with one of the two genomes of *S. longipedicellatum*. The amphidiploid is therefore given the genome formula LLCCCC. It is concluded that bivalent formation in triploids from *S. longipedicellatum* x *S. chacoense* and *S. longipedicellatum* x *S. schickii* is allosyndetic [cf. XXIX, 2788 and 4024].

2852 KOOPMANS, A.
Changes in sex in the flowers of the hybrid *Solanum rybinii* x *S. chacoense*. IV. Further data from the reciprocal cross *S. chacoense* x *S. rybinii*.
Genetica 1959 : **30** : 384–90.

As already reported [cf. XXV, 3182], the F_1 from a cross between a particular strain of *S. chacoense* ♀ and *S. rybinii* ♂ contained a number of flowers in which the anthers were very thin and without pollen, although normal in length. An F_2 raised from normal F_1 individuals and also from abnormal F_1 plants by pollinating with normal F_1 parents included a large number of plants with the same type of abnormality. Progenies obtained from back crosses of normal and abnormal F_1 individuals with *S. rybinii* ♂ also contained many plants with abnormal anthers, the percentage being higher in the offspring of the latter group of parents. The present paper gives a report of the results obtained by back crossing, to both *S. rybinii* ♂ and *S. chacoense* ♂, abnormal plants in the F_2 and also from the F_1 back crossed with *S. rybinii*. The combined data from this and the earlier investigation indicated that back crossing to *S. rybinii* increased the percentage of abnormal plants, whereas progenies produced by back crossing to *S. chacoense* consisted completely or almost completely of normal plants. Further support was therefore obtained for the author's supposition of lack of coordination on the one hand between *S. chacoense* genes and *S. rybinii* cytoplasm and on the other between *S. rybinii* genes and *S. chacoense* cytoplasm, the genes for flower structure, in particular, being easily influenced by foreign cytoplasm.

2853 BRÜCHER, E. H.
La importancia de las variedades autóctonas y de las especies silvestres de "Solanum" de la República Argentina para la fitogenética internacional. (**The importance of the native varieties and wild species of *Solanum* of the Argentine Republic in international plant genetics**).
Rev. argent. Agron. 1959 : **26** : 53–56. (Abst.).

A survey of the breeding value of Argentine wild species is presented; the various species are used as sources of resistance to eelworm, frost, leaf hopper, Colorado beetle and viruses.

2854 GEORGIEVA, R.
(**Selection indices in the early stages of development of potato hybrids**).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1958 : **5** : 23–40 [Bulgarian].

Interspecific and intervarietal hybrids were classified according to certain combinations of morphological characters at the pricking-out stage; their characters were also assessed when the plants were ready to be planted in their permanent positions in the field and again when they were fully mature. The results showed that for all the hybrids investigated selection may be successfully carried out at the pricking-out stage; the most promising plants are those which show at this stage short tuber stems and small tubers which appear to be attached to the base of the stems.

2855 KELLER, E. R.
Das schweizerische Richtsortiment im Kartoffelbau 1959/60. (**The Swiss official collection in potato cultivation, 1959/60**).
Mitt. schweiz. Landw. 1959 : **7** : 145–51.

Tabulated notes are provided on the most important characters of 15 varieties.

2856 Avenir, eine neue, weissfleischige Speisekartoffel im Richtsortiment. (**Avenir, a new white-fleshed culinary potato in the official collection**).
Mitt. schweiz. Landw. 1959 : **7** : 157–60.

Avenir [Future] has been described elsewhere

[cf. XXVIII, 783]. It originated from the cross (A42 x Voran) x Katahdin.

2857 Lenčenko, P. D.
(My experiments in research).
Kartofel' (Potato), Moskva 1959 : No. 3 : 62–63. [Russian].

This account of potato breeding in the province of Smolensk mentions two selections from unspecified local varieties. One of these is a late variety with pink tubers having pleasant flavour; the other is early, has round pale-pink tubers and overwinters in the field without injury when digging is delayed.

2858 **(Awards to plant breeders).**
Kartofel' (Potato), Moskva 1959 : No. 2 : p. 57. [Russian].

The potato breeders responsible for developing Petrovskij, Priekul'skij Rannij [Priekuļi Early], Èksport [Export] and Južanin [Southern] have been given cash awards. These varieties are midseason types and, with the exception of Južanin, are resistant to wart.

2859 Kondrat'ev, V. N.
(We will produce more potatoes for Leningraders).
Kartofel' (Potato), Moskva 1959 : No. 3 : 11–14. [Russian].

Plans for increased potato production in Leningrad province include introduction of the new potato variety Krasnooktjabr'skij 12 [Red-October 12]. It is stated to be resistant to wart and water-logged soil, as early as Priekuļi and 35–50% more productive than local standard varieties. It outyields Priekuļi by an appreciable margin both when dug on 20 July and 20 September.

2860 Peloquin, S. J. & Hougas, R. W.
Decapitation and genetic markers as related to haploidy in *Solanum tuberosum*.
Europ. Potato J. 1959 : **2** : 176–83.

The decapitation technique, which has been reported elsewhere [cf. XXIX, 1696], is an effective method of increasing the seed set in difficult crosses between *S. tuberosum* and diploid species of *Solanum*. By means of genetic markers, an early removal of hybrids from the F_1 progeny of these crosses is possible and so the search for haploids is facilitated. A useful marker is embryo spot, a red or blue coloration at the nodes of the cotyledons; it occurs in selections of *S. phureja*. Attempts are being made to synthesize pollinators homozygous for the genes determining this character [cf. XXVI, 2561]. Also the synthesis of pollinators quadriplex for the gene *P* is being attempted; this gene conditions purple pigmentation of the hypocotyl and is a very efficient marker. It would be particularly useful in crosses between tetraploids, where seed set would be high but the proportion of haploid progeny would probably be very low.

2861 Lebedeva, N. A.
[Changes in the potato (*Solanum* spp.) accompanying polyploidy].
Bot. Ž. (Bot. J.), Moskva 1959 : **44** : 1075–90. [Russian].

Sprouts of certain species such as *S. gibberulosum*, *S. parodii* and *S. kesselbrenneri* could withstand colchicine concentrations of 0·6–0·7% whereas for most species the maximum concentration was 0·5%. In self-fertile species the treatment was applied to the seed.

Certain species such as *S. gibberulosum* and *S. kesselbrenneri* are heterozygous and their polyploids showed wide segregation, whereas polyploids from *S. schreiteri* and *S. punae* were uniform, being somewhat larger than the initial plants and a few days later in flowering; the polyploids from most species were reduced in fertility, though those from *S. antipoviczii* and *S. macolae* displayed high fertility. The fertility of the sterile polyploids often increased notably in later generations; thus the first polyploid generation from *S. punae* ($2n = 96$) had only 10–12 seeds per berry, the second seed generation had 20–30 and the fourth up to 200, though no reversion in chromosome number had occurred. Similarly in *S. gibberulosum*, the first polyploid generation had 5–8 seeds whereas the fifth had over 400.

The polyploids in most species exceeded the initial forms in yield of tubers, which in *S. gibberulosum* was increased by 25 times. One of the most difficult species to produce polyploids from was *S. tuberosum* and in this species there was no increase in tuber yield.

Some increase in frost resistance was observed in the polyploids from *S. punae* ($2n = 96$), which were less damaged by — 9° C. than the original seedlings with $2n = 48$, which tolerated only — 7 to — 8°C. The resistance to common and aggressive races of late blight was not reduced in polyploid seedlings of *S. demissum* and *S. antipoviczii* and was slightly increased in one form of *S. demissum*. Polyploid seedlings of *S. gibberulosum* were more resistant than the diploids to attack by *Epilachna vigintioctomaculata*.

The capacity to cross with other species was increased in most of the polyploids and those from *S. schreiteri*, *S. punae* and *S. antipoviczii*,

the diploids of which do not cross at all with domestic varieties, crossed quite easily with them and with a number of other species. On the other hand the polyploids from *S. demissum* crossed less readily with domestic varieties. Most of the seedlings from crosses of *S. punae* and *S. schreiteri* with domestic varieties had $2n = 72$, though some had $2n = 96$; those from *S. gibberulosum* and *S. parodii* mostly had $2n = 48$, though some had $2n = 96$.
The polyploids of *S. kesselbrenneri* had a higher starch content in the tubers, whereas in those from most species it was reduced in the polyploids. Protein content was either unchanged or increased, in polyploids of *S. demissum* from 2·51 to 4·34%. There was an increase in polyphenoloxidase activity in some polyploids and a reduction in ascorbic acid oxidase in others. Polyploids of species of series *Acaulia* had increases of 3–5 times in demissin content.

2862 Glück, J. & Lipińska, J.
Badania nad żywotnością pyłku ziemniaka. (**Investigations on viability of potato pollen**).
Hodowla Roślin Aklimatyz. Nasiennictwo 1958 : **2** : 603–22.

Observations on the germination of pollen grains in 20% and 30% sucrose solutions were made with pollen collected at three different times from various species and hybrids. In some varieties and hybrids, pollen collected at the later phases of growth gave the highest germination and the longest pollen tubes and in others that collected at an earlier phase was best; the difference was not constant however but varied at different places and in different seasons. Nor were the highest germination and the longest pollen tubes always found at the same time. The diameter of the pollen grains that germinated was 37–41μ for *Solanum tuberosum*, 41–46μ for *S. andigenum*, 28–38μ for the wild species examined and 38–52μ for the hybrids. Somewhat less variation was observed in the diameter of the pollen grains that did not germinate. The percentage of pollen grains that germinated was highest in Działkowiec, with 52%, among the domestic varieties; some of the wild species had higher figures, the percentage reaching 75% in *S. commersonii*. The percentage of deformed pollen grains was also higher in the hybrids and in the domestic varieties than in the wild species.
Tabular data are provided in which the percentage set of fruits in a number of interpollinations is compared with the data on pollen germination. In over 75% of cases the two sets of data showed good agreement, though in certain combinations pollen with low germinating capacity gave relatively good sets.

2863 Fischnich, O. & Krug, H.
Gibberellin in der Hand des Kartoffelzüchters. (**Gibberellin in the hand of the potato breeder**).
Kartoffelbau 1959 : **10** : 189–91.

In some of the varieties tested, treatment with gibberellin resulted in earlier flowering and an increased production of flowers. Using this treatment it may be possible to effect crosses between varieties which normally flower at different times. Also the varieties Olympia, Vertifolia and Ackersegen produced after treatment some flowers under short-day conditions; hence it will be possible to cross varieties during winter months. Treated plants had a good fruit set with normal seed after pollination with pollen from untreated plants. It was also possible to break the dormancy of seeds and to promote the growth of eye cuttings by gibberellin treatment.

2864 Siebeneick, H.
Beobachtungen an der Fleischfarbe der rohen Kartoffel. (**Observations on the flesh colour of the raw potato**).
Europ. Potato J. 1959 : **2** : No. 4 : 229–37.

Observations on the flesh colour of 34 German varieties are reported. It was found that, whilst the colour of some varieties such as Bona showed little variation, the colour of others such as Oberarnbacher Frühe [Oberarnbach Early] was very variable. Also the colour of many varieties altered during storage, this being particularly marked on those with a high starch content. Some notes are also given on the colour characters of the flesh of varieties from other countries.
No relation has been found between colour of flesh and colour of skin. Most varieties have evident medullary rays in the tubers and the colour of these is a varietal character.

2865 Kirillov, I. F.
(**The best seed material for the south**).
Kartofel' (Potato), Moskva 1959 : No. 2 : 22–24. [Russian].

The production of seed potatoes and seedlings in the arid climate of Tajikistan is discussed. Mention is made of experiments on pollination at the Mičurin Institute in Tajikistan where such varieties as Lorh and Korenevo, which normally shed their flowers, developed berries and seed.

2866 Brücher, H.
Kritische Betrachtungen zur Nomenklatur argentinischer Wildkartoffeln. VI. Die Serie *Alticola* (= *Megistacroloba*). [**Critical considerations on the nomenclature of Argentine wild potatoes. VI. The series *Alticola* (= *Megistacroloba*)**].
Züchter 1959 : **29** : 257–64.

Field studies of this series were carried out in Bolivia and Argentina. It is suggested that the taxa *S. alticolum* and *S. megistacrolobum* created by Bitter should be retained but Hawkes's *S. tilcarense* and *S. alticola* var. *xanthotrichum* are not considered to be distinct from *S. alticolum*. Also it is thought that the *S. santae-rosae* of Hawkes should be known as *S. catamarcae*, this name having been suggested 50 years ago by Bitter for the same plant. Descriptive notes on *S. alticolum*, *S. megistacrolobum* and *S. catamarcae* are given; these species all have a chromosome number of $2n = 24$ and are highly resistant to frost.

2867 Gell, P. G. H., Hawkes, J. G. & Wright, S. T. C.
The application of immunological methods to the taxonomy of species within the genus *Solanum*.
Proc. roy. Soc. : Ser. B 1960 : **151** : 364–83.

Modifications of the Elek-Ouchterlony gel-diffusion technique and immunoelectrophoretic method of Grabar and Williams were applied in an immunological analysis of *S. tuberosum* and 15 Mexican and 22 South American species at the University of Birmingham, England [XXVI, 2586]. Antisera to extracts from tubers of *S. tuberosum* and *S. ehrenbergii* were raised in rabbits, using a combination of the adjuvant technique devised by Freund and Bonanto with courses of intravenous injections. According to tests of tuber extracts against *S. tuberosum* antiserum, the series represented by the Mexican species could be placed in three groups: (1) *Bulbocastana* (*S. bulbocastanum*), *Demissa* (*S. demissum*, *S. guerreroense*, *S. semidemissum*, *S. spectabile*, *S. verrucosum*), *Longipedicellata* (*S. polytrichon*, *S. stoloniferum*) and *Polyadenia* (*S. polyadenium*), giving four precipitin lines similar to those obtained with *S. tuberosum*; (2) *Cardiophylla* (*S. cardiophyllum*, *S. ehrenbergii*, *S. sambucinum*) and *Pinnatisecta* (*S. pinnatisectum*, *S. jamesii*) with two lines; and (3) *Morelliformia* (*S. morelliforme*) with one line. All the South American species gave reactions practically identical with those of *S. tuberosum*; only the results with the Mexican species are therefore considered in detail. The three groups agree fairly well with interspecific relationships based on morphological and crossability data. Series *Bulbocastana*, *Polyadenia* and *Commersoniana* constituted apparent exceptions. It is suggested that, with respect to serological reactions, the first two of these series may be regarded as linking groups which have evolved in a manner similar to the series in (1), while retaining morphological and fertility relationships with the more primitive stellate-flowered series *Pinnatisecta* and *Cardiophylla*. The stellate corolla in the *Commersoniana* may possibly be a feature derived fairly recently from the rotate corolla of the *Tuberosa*; the cytogenetical evidence points to a close relationship between the two series. Analysis of species representing the *Demissa*, *Longipedicellata*, *Bulbocastana*, *Cardiophylla* and *Pinnatisecta* by means of *S. ehrenbergii* antiserum adsorbed with *S. tuberosum* extract gave results which were somewhat more difficult to interpret.

Apart from the value of serological evidence to the taxonomist, such information may also be of use to the breeder. Thus, *S. bulbocastanum*, of interest by reason of its immunity from late blight, may be more closely related to the *Tuberosa* than its gross morphology and failure to cross with members of this series would suggest. Furthermore, in tests with adsorbed *S. ehrenbergii* antisera, *S. bulbocastanum* displayed close similarities to the spectra of *S. polytrichon*, *S. jamesii* and *S. pinnatisectum*. Intensive attempts to hybridize *S. bulbocastanum* with these three species are therefore considered to be probably worth while.

It is pointed out in the general discussion that great similarity may possibly exist throughout a wide range of plants between the proteins involved in a generalized function such as photosynthesis, while storage proteins from seeds or tubers may be expected to be less different from each other than proteins from the same or other sources more actively responsible for specific characters. Thus the choice of appropriate organs and tissues and the serological characterization of the proteins in extracts from them may help to elucidate all degrees of genetic relationship.

2868 Steineck, O.
Der Ertragsaufbau der Kartoffel. (**Yield components of the potato**).
Bodenkultur 1959 : **10** : 231–45.

A yield analysis of 12 varieties of different maturity periods is reported; the characters considered are the number of shoots per plant, the number of tubers per shoot and the average

weight of a tuber. These yield components differed in their importance for each variety. The varieties could be classed into three groups with low, medium and high numbers of shoots per plant. The higher the shoot number, the lower was the number of tubers per shoot The total number of tubers per plant increased with the number of shoots but the relationship was complex. Also the average tuber weight and the number of tubers were negatively correlated. No relationship was found between the yield of an individual plant and the number of tubers. The effect of environmental conditions and especially of the water supply on yield components is discussed.

2869 Thijn, G. A.
Aardappelveredeling in een zonnige zomer. (**Potato breeding in a sunny summer**).
Zaadbelangen 1959 : **13** : 369–71.

Some of the breeding difficulties associated with the high incidence of pests and diseases in the warm dry summer of 1959 are mentioned.

2870 Wolcott, A. R. & Ellis, N. K.
Internal browning of potato tubers: varietal susceptibility as related to weather and cultural practices.
Amer. Potato J. 1959 : **36** : 394–403.

Waseca, Setapa, Katahdin, Irish Cobbler and Cherokee were consistently resistant to moderately resistant in all plantings. Ontario and Sebago were consistently susceptible. Russet Rural, Russet Burbank, Pontiac, Redkote, Triumph, Kennebec and Chippewa showed extreme variability in the degree of injury sustained. In all plantings there was a marked tendency for injury to be greatest in the later maturing varieties.

2871 Münster, J.
La maladie des taches de rouille de la pomme de terre en 1959. (**Internal rust spot disease of potato in 1959**).
Rev. rom. Agric. 1959 : **15** : 97–99.

Eleven potato varieties are listed in order of susceptibility to the physiological disease known as internal rust spot or sprain.

Fortieth Report of the Quebec Society for the Protection of Plants. 1958 : Pp. 152.

2872 *Généreux, H. & Lachance, R. O. Susceptibilité de variétés de pommes de terre et d'espèces de* Solanum *à la flétrissure bactérienne. (The susceptibility of potato varieties and of other* Solanum *species to bacterial rot). (pp. 86–87).*

The reaction of a number of commercial potato varieties to infection by *Corynebacterium sepedonicum* was investigated. No relation was found between the degree of infection shown by the foliage and that shown by the tubers. Considerable variation was found in the ability of both foliage and tubers to harbour the disease without showing symptoms.
Of ten *Solanum* species inoculated in the greenhouse, only two showed external symptoms, yet all but one were found to be infected.

2873 Wolffgang, H. & Hoffmann, G. M.
Die Bedeutung der Chlorogensäure als Resistenzfaktor des Kartoffelschorfes. (**The importance of chlorogenic acid as a factor in resistance to potato scab**).
Züchter 1959 : **29** : 335–39.

The chlorogenic acid and caffeic acid contents of the tuber skin of 40 varieties differing widely in their susceptibility to *Streptomyces scabies* were determined and no correlation was found between the contents of these substances and resistance to scab.

2874 Campagna, E.
Étude de la résistance de diverses variétés de pommes de terre. a) à la brûlure tardive: b) à la gale commune: c) aux maladies à virus. (**A study of the resistance of various potato varieties to a) late blight b) common scab and c) virus diseases**).
Rech. agron. Québec 1959 : No. 4 : 43–44. (Abst.).

A list is given of early, mid-season and late varieties which are resistant to each of the above diseases and suitable for growing in Canada.

2875 Galindo A., J. & Gallegly, M. E.
The nature of sexuality in *Phytophthora infestans*.
Phytopathology 1960 : **50** : 123–28.

A technique was developed for tracing by direct observation the antheridial and oogonial hyphae formed in different pairings. It involved separating colonies of opposite type by aluminium foil perforated by holes whose small size, distribution and limited number restricted the number and position of the hyphae growing out into a contiguous block of water agar. Observations on the results of pairing 9 isolates of the A^1 type with 3 of the A^2 type in all combinations revealed that each isolate was bisexual and that

the so-called mating types are actually compatibility types. Relative degrees of maleness and femaleness were encountered within each compatibility type. A given isolate behaved as ♀ in some pairings and as ♂ in others. In still other pairings the same isolate produced both ♂ and ♀ gametangia. The isolates ranged from those with a strong ♂ tendency to those in which femaleness predominated. Preliminary data suggested that the reaction of an isolate may change with alteration in its vigour of growth. In pairings of compatible isolates of equal sexual strength, hyphae of the A^1 type which had been starved produced only antheridia when paired with an unstarved isolate of the A^2 type, whereas the unstarved A^1 types produced only oogonia when the A^2 type was starved.

2876 Świniarski, E., Mierzwa, Z. & Świszczewska, J.
Zagadnienie biochemicznej odporności ziemniaka na zarazę ziemniaczaną (*Phytophthora infestans* de Bary). [**The problem of the biochemical resistance of potatoes to potato blight (*Ph. infestans* de Bary)**].
Hodowla Roślin Aklimatyz. Nasiennictwo 1959 : **3** : 393–403.

No relation between varietal resistance and nitrogen content of the tubers was observed, but within varieties both resistance and nitrogen content of the leaves decreased towards the end of the vegetative period. There were indications that the content of chlorogenic acid in the tubers may be related to resistance. Peroxidase activity of the tubers differed little among resistant and susceptible varieties, but resistant wild species all showed a high activity.

2877 Bonde, R., Akeley, R. & Merriam, D.
Late blight resistance of selected potato seedlings highly resistant to ring rot.
Plant Dis. Reptr. 1959 : **43** : 924–28.

Five seedlings of potato varieties known to be resistant to *Corynebacterium sepedonicum* were tested for resistance to *Phytophthora infestans*. No foliage infection was found on B3879–3 (Ac25955 x B355–24) and only a trace on three other lines, B3201–38, B4157–1 and B3686–1. No tuber decay occurred. Of commercial varieties, only Sebago showed an appreciable degree of field resistance.
Varieties Kennebec and Cherokee are resistant to race 0 of *Ph. infestans* but their tubers are severely susceptible to decay.

2878 Ullrich, J.
Untersuchungen zur Beurteilung der Resistenz von Kartoffelsorten gegenüber *Synchytrium endobioticum* (Schilb.) Perc. [**Investigations on estimating the resistance of potato varieties to *S. endobioticum* (Schilb.) Perc.**].
Phytopath. Z. 1960 : **37** : 217–35.

After artificial inoculation with *S. endobioticum*, highly resistant varieties show only a few isolated areas of infection on the shoot whereas varieties of low resistance may have similar isolated infections or the infections may occur more closely together, in some cases forming a "field" of infection; the varieties of medium resistance do not have this dense type of infection. The reaction of the plant is independent of the amount of infection. Varieties of low resistance may produce many tumours as in Deodara or the ability to form tumours may be reduced or absent as in Roode Star [Red Star] and Urgenta respectively. Also varieties of medium resistance such as Virginia may occasionally form tumours in the field. On these varieties there is the possibility that resting spores of the pathogen may be formed and hence it is thought that these types should not be cultivated. When tumours occur on a fairly resistant type like Virginia, the existence of a new race of the pathogen may be wrongfully assumed.

2879 Blattný, C.
Doplněk k práci J. Zakopala a B. Spitzové: Příspěvek k otázce ras či biotypů (*formae speciales*) rakoviny bramborů *Synchytrium endobioticum* (Schilb.) Perc. v Československu. [**A supplement to the work of J. Zakopal and B. Spitzova: A contribution to the question of races or biotypes (*formae speciales*) of potato wart, *S. endobioticum* (Schilb.) Perc., in Czechoslovakia**].
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 277–80.

The work referred to above has already been summarized [cf. XXIX, 4066]. Further experiments have confirmed that there is at present only one biotype of *S. endobioticum* in Czechoslovakia. This biotype is now thought to differ from those occurring in Germany and other countries. [Cf. XXX, 1717].

2880 Müller, W. A.
Infektionsversuche mit *Synchytrium endobioticum* an Keimpflanzen von Kartoffeln. (**Infection experiments with *S. endobioticum* on seedlings of potatoes**).
Züchter 1959 : **29** : 280–81.

Seedlings were infected when germination had just begun; a drop of distilled water and a tumour from an infected plant were placed on the seedlings which were then kept at 15° C. for 24 hr. before pricking out. If this treatment was given before the cotyledons and growing point had emerged from the testa only the hypocotyl was infected and the seedlings continued to develop and produced tubers whereas infection of the growing point inhibited further development. It is possible to distinguish susceptible seedlings 14 days after infection; seedlings which show no sign of attack at this stage must undergo further tests.

2881 Kočetova, Z. M.
(**How to control *Fusarium***).
Kartofel' (Potato), Moskva 1959 : No. 2 : 56–57. [Russian].

Measures for controlling *Fusarium* wilt and related diseases of the potato were studied in the province of Orenburg. The varieties Oktjabrenok [Little Octobrist], Varba, Ul'janov and Jubilejnyj [Jubilee] were found to be resistant.

2882 Schmidt, H.
Der Stand der Forschung auf dem Gebiet des Kartoffelnematoden. (**The state of research concerning the potato nematode**).
Wiss. Z. Martin-Luther-Univ. Halle-Wittenberg 1958–59 : **8** : 295–321.

The subjects covered in this review include the results of testing wild and cultivated potatoes for resistance, hybridization between resistant wild species and cultivated varieties, the inheritance and nature of resistance, the occurrence of aggressive biotypes on resistant clones, and technical problems in breeding for resistance.

2883 Stelter, H.
Einige Beobachtungen an nicht-knollentragenden Solanaceen in bezug auf den Kartoffelnematoden (*Heterodera rostochiensis* Wr.). [**Some observations on nontuberous Solanaceae with reference to the potato nematode (*H. rostochiensis* Wr.)**].
NachrBl. dtsch. PflSchDienst., Berl. 1959 : **13** : p. 135.

A series of *Solanum* species were tested and counts were made of the infected plants. *S. cervantesii, S. abutiloides, S. sodomaeum, S. auriculatum* and *S. wipposense* were not attacked.

2884 Tîktin [Tyktin], N. V.
Rezistenta cartofilor la nematodul *Heterodera rostochiensis* W. (**The resistance of potatoes to the nematode *H. rostochiensis* W.**).
An. Romîno-Soviet. : Ser. Agric.-Zooteh. 1959 : **13** : No. 2 : 107–11.

[Cf. XXIX, 4071].

2885 Hoppe, W.
Badania wstępne nad śmiertelnością larw stonki ziemniaczanej na różnych Solanaceae. (**Preliminary studies on the larval mortality of Colorado beetle on different Solanaceae**).
Roczn. Nauk rol. : Ser. A 1958 : **77** : 603–09.

The species examined are arranged into four groups according to the degree to which the larvae would feed on them. No feeding at all took place on *Solanum capsicastrum* and certain species of *Nicotiana* and other genera; very little feeding occurred on *S. alatum, S. nitidibaccatum, S. nigrum* and two forms of *S. demissum* tested. Feeding took place most readily on *S. rostratum, S. heterodoxum, S. melongena, S. dulcamara* and *S. tuberosum*, the other species tested being intermediate. These findings are compared with those published in the literature.

2886 Pierzchalski, T.
Zmiany stężeń glikoalkaloidów w liściach ziemniaków uprawnych, dzikich i ich mieszańców w czasie wzrostu oraz ich wpływ na stonkę ziemniaczaną.
(**Changes in the concentration of glycoalkaloids in the leaves of cultivated and wild potatoes and their hybrids during growth and their influence on the Colorado beetle**).
Hodowla Roślin Aklimatyz. Nasiennictwo 1957 : **1** : 415–30.

By means of a colorimetric method based on orcein HCl with ferric chloride, analyses were made of the leaves and tubers of *Solanum demissum, S. chacoense, S. tuberosum* and a number of hybrids. The concentration of glycoalkaloids increased during the growth period but at a different rate in different varieties. It later diminished, but also at a different rate in different varieties, the hybrid Błękit

from *S. demissum* x *S. tuberosum* maintaining its high values for a much longer period than most others. High values also tended to be maintained more in wild than in cultivated species. The development of larvae of *Leptinotarsa decemlineata* was depressed on the leaves of *S. demissum* and *S. chacoense* and less on hybrids 12872 and Błękit, both from *S. demissum*, than on the domestic variety Dar [Gift]. Larval development was greater in June and July than in August and September; it also differed on leaves at different heights, these differences being probably associated with alkaloid content, the upper leaves containing more alkaloid than the lower. The alkaloid content was also greater in young tubers than in old.

2887 Świniarski, E., Werner, E. & Mierzwa, Z.
Pewne zagadnienia biochemicznej odporności dzikich gatunków ziemniaka na larwy stonki ziemniaczanej (*Leptinotarsa decemlineata* Say). [**Some problems of biochemical resistance of wild species of potato to the larvae of the Colorado beetle (*L. decemlineata* Say.)**].
Hodowla Roślin Aklimatyz. Nasiennictwo 1958 : **2** : 623–31.

Sap of the leaves of *Solanum demissum*, *S. chacoense*, *S. polyadenium* and *S. tuberosum* was placed on leaves of the susceptible domestic potato Dar [Gift] in amounts corresponding to 50 mg. per 100 mg. of leaf, larvae being placed on the leaves 2–3 hr. later. Similar tests were made with ethereal extracts from the leaves. The results showed that sap from *S. demissum* and *S. polyadenium* had a similar depressing action on larval development, though the amount of demissin in the latter species was much less than in *S. demissum*. *S. chacoense* has a highly depressing effect and large quantities of glycoalkaloids in its leaves. The ethereal extracts of leaves of all three resistant species also depressed larval development, which shows that the substances responsible for resistance in *S. polyadenium* are ether-soluble.
The lower leaves, though containing less alkaloids, inhibited larval growth more than the upper leaves of most varieties and hybrids; moreover, the alkaloid content of resistant forms of *S. chacoense* proved to be lower than that of susceptible forms of that species. The larval development thus seems to be influenced also by some substances other than alkaloids in the leaves; in *S. chacoense* these substances are not soluble in water.

2888 Cieślewicz, I. & Świniarski, E.
Zagadnienie glikoalkaloidów w hodowli odpornościowej ziemniaka. (**The problem of glycoalkaloids in breeding resistant potatoes**).
Hodowla Roślin Aklimatyz. Nasiennictwo 1957 : **1** : 405–14.

The alkaloids demissin in *Solanum demissum* and chaconin and solanin in *S. chacoense* inhibit the development of Colorado beetle larvae, the effect of solanin being weaker than that of demissin [cf. XXVIII, 1835]. In hybrids involving the two species alkaloids were present in both leaves and tubers, the tubers of resistant plants being very bitter.

2889 Rothacker, D. & Witt, I. K.
Untersuchungen über das Verhalten zentral- und südamerikanischer Kartoffel-Species nach Infektion mit dem Rippenbräune-Stamm des Y-virus (RBV). (**Investigations on the behaviour of Central and South American potato species after infection with the brown-vein race of virus Y.**).
Züchter 1959 : **29** : 271–76.

Resistance to the brown-vein virus was assessed in 613 provenance types of 38 species. Some resistant types were found in the series *Commersoniana* and *Longipedicellata* and in *Solanum spectabile*, *S. pinnatisectum*, *S. tuberosum* subsp. *andigenum*, *S. macmillanii* and *S. simplicifolium*.

2890 MacKinnon, J. P. & Munro, J.
Comparative rates of movement of potato virus X into tubers and eyes of three potato varieties.
Amer. Potato J. 1959 : **36** : 410–13.

The virus reached all tubers of Keswick, Canso and Katahdin when the leaves of these varieties were inoculated 55 days before harvesting. When the interval between inoculation and harvest was decreased, Katahdin produced fewer infected tubers than the others. In partially infected tubers of Keswick the virus was found in eyes from the eye end more frequently than in eyes from the stem end.

2891 Thijn, G. A.
Iets over kringerigheid. (**On corky ring spot**).
Zaadbelangen 1959 : **13** : p. 459.

In this discussion of a paper already summarized [548], it is noted that nine of the resistant potato varieties and selections tested include x 96–56 in their parentage. It is

concluded that this parent is a good transmitter of resistance.

2892 Kehr, A. E. & Horton, J. C.
Resistance of potato to infection by mechanically introduced virus X.
Amer. Potato J. 1960 : **37** : 61–66.
A detailed account is given of investigations which have been briefly reported elsewhere [cf. 516].

2893 Wiersema, H. T.
Het kweken op virusresistentie bij de aardappel. (**Breeding for virus resistance in potato**).
Meded. Ned. Alg. Keuringsdienst Landbouwzaden Aardappelpootgoed 1959 : **16** : 77–80.
Three types of virus resistance are distinguished: (1) incomplete resistance, determined by multiple genes and necessitating a high level of resistance in both parents in breeding; (2) hypersensitivity, governed by a single dominant gene; and (3) extreme resistance, also dominant and monogenically controlled and apparently effective against all strains of the virus in question. Resistance to leaf roll is of type (1) and is found in Aquila, Burmania, Froma, Meerster and ZPC45–2. Resistance to virus A is of type (2), is effective against all strains and occurs in many varieties including all those hypersensitive to the common strain of virus X. Specific hypersensitivity to individual strains of virus X is found in Bintje, Furore, Libertas, Noordeling, Record, Voran, Ambassadeur and others. Type (3) resistance to virus X is present in USDA41956, in *Solanum acaule* and *S. andigenum*. All three types of resistance to virus Y strains are known, type (2) resistance to the stipple-streak strain occurring in several varieties and type (3) in *S. chacoense* and *S. stoloniferum*. Seedlings combining extreme resistance to all three viruses have been developed at the Netherlands Plant Breeding Foundation.

2894 Daskalov, H., Murtazov, T. & Rusenova, I.
(**Studying some varieties of sweet potato, *I. batatas*, and the possibility of cultivating it in our country**).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1958 : **5** : 159–71. [Bulgarian].
Ten Chinese varieties and two American varieties were tested. The Chinese varieties were found to be suitable for cultivation in Bulgaria on account of their short vegetative period, high yielding ability and good keeping capacity. The varieties 169 and Sheng-li 100 were the best.

2895 Poole, C. F.
Improvement in yield of sweet potato clones.
Proc. Amer. Soc. hort. Sci. 1959 : **73** : 445–52.
The possibility of selecting naturally occurring and radiation-induced bud mutants for yield has been explored at the Hawaii Agricultural Experiment Station. The initial material used in the search for natural mutants consisted of 300 roots of the standard ten-year-old clone Onolena from three farms on Oahu. By selection in two successive clonal settings, three plus and three minus clones were obtained. As the result of a final trial, two of these clones, C (+) and A (—), were picked out for inclusion in tests at the three farms along with eight randomly chosen root progenies from sprouted and dormant roots which had been exposed to Co^{60} in moistened cloth bags at a dosage of 2350 r. over 72 hr. As a group, progenies derived from sprouted roots outyielded those from dormant roots. Clone C again showed superiority over A. Possible genetic and non-genetic causes of the higher yield of the first-mentioned group of progenies are considered.

2896 Nagase, J., Maeda, I. & Kurematsu, H.
(**On the diameter of the starch grains of the sweet potato**).
Mie Diagaku Nogakubu Gakujutsu Hokuku/Bull. Fac. Agric. Mie Univ. 1959 : No. 19 : 59–65. [Japanese].
Frequency distributions of starch grain diameter were determined for 10 varieties. Small intervarietal differences were noted.

2897 Hirai, G. & Nishikawa, M.
(**Studies on the causes of the differences in percentage dry matter of sweet potatoes. II. The relations between the osmotic pressure in the various parts of the sweet potato, expecially the root tuber, and the percentage dry matter**).
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1959 : **28** : 126–28. [Japanese].
Twelve varieties were studied, four with high, four with intermediate and four with low starch contents. In varieties of the first category, the osmotic pressure tends to rise sharply till noon and then decline gradually; in varieties of the third category, if the osmotic pressure rises in the morning, it declines sharply in the afternoon, or it may decline slowly throughout the day with no pronounced peak around noon.

Varieties of the second category are intermediate in their behaviour.

2898 NISHIYAMA, I.
(Sweet potatoes and related plants introduced from North America and Mexico).
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 73–78. [Japanese].

A preliminary description is given of a collection of cultivated sweet-potato varieties and wild species of *Ipomoea, Pharbitis, Caloniction* and *Quamoclit* introduced into Japan by the author from the USA, Hawaii and, most particularly, Mexico. Chromosome counts of the *Ipomoea* material have revealed somatic chromosome numbers of $2n = 30$, 60 and 90. Some successful crosses have been made between cultivated sweet potatoes and wild *Ipomoea* material with $2n = 90$, but crosses between cultivated varieties and wild *Ipomoea* forms with 30 or 60 chromosomes produced no viable offspring.

2899 HILDEBRAND, E. M.
Preliminary observations on the internal cork virus complex in the sweetpotato.
Plant Dis. Reptr. 1959 : **43** : 1070–72.

Three North American strains of internal cork virus have been distinguished on the basis of incubation period and symptoms produced on Scarlett O'Hara morning glory. Strains 1 and 2 sometimes occur mixed.

FIBRES

Progress Reports from Experiment Stations, season 1957-58.
Emp. Cott. Gr. Corp. Lond. 1958 and 1959.

The summaries given below complete the coverage of the series of reports for the season 1957–58 [cf. 1749–53].

Cotton Research Station, Namulonge, Uganda. Progress report for the season 1957–58.

2900 *Manning, H. L., Faulkner, R. C. & Walker, J. T. Plant Breeding. (pp. 48–57).*

The modal bulk technique of maintaining BP52 has now been in operation for ten successive generations [cf. XXIX, 4097]. Over ten years lint per seed and seed weight have increased slightly. Increase in lint length was very rapid during the past eight seasons. The effects of the increase in seed weight have been reflected in the ginning outturn of the later modal bulks, the value now being about 32% compared with 33% for the original material. "The cumulative selection differential for the yield of selected plants, over the mean of the population from which they were selected, is estimated to be 38% for 11MB, representing an annual value of about 3·5%. During the course of the season further information was accumulated in regard to the actual yield performance of some of these modal bulks. The best estimate of their large-scale yield performance is described by the regression equation: $YE = 106{\cdot}47 + 1{\cdot}152X$, where X is the specific modal bulk and the data are given as percentages of the original bulk equivalent to 100. Thus BP52/9MB is expected to be 18·0% better. The actual yield advance is shown to be about half that indicated by the selection differential, so that the realised heritability is about 0·25." Improvement of the yield of BP52 by the progeny-row method also continued. The yield increment expected from the progenies selected in 1957–58 is of the order of 3%.

Data were obtained from a further BP52 progeny bulks trial. Taking the original bulk as 100%, the lint yield per acre for the mean of the selected strains is now calculated to be about 127%. The best single strain had a yield value of 132·9%.

The results of variety trials during the past 15 seasons are analysed to assess progress made in securing yield improvement over local BP52. The predicted value of the best of the C(55) series, representing eight generations of breeding, is an increment of about 28% over local BP52. Albar/2MB and UPA/2MB modal bulks were established; the "static" bulks Albar/2B and UPA/2B were also produced [cf. *loc. cit.*]. On the bases of high yield, ginning outturn, lint index, seed weight and lint length, five Albar and six UPA progenies were selected for a 1958–59 progeny-row trial. F_6 selections of Albar 49 x BP52², Albar original modal bulk, Albar/2MB, UPA original modal bulk and UPA/2MB will also be included.

2901 *Walton, P. D. Cotton breeding at Serere. (pp. 58–67).*

Modal-bulk production of DE, BP50, N17, UPA, Albar, S47 and S4108 continued.

The results of (1) trials of S47 (control), LA, S4108 and multiline strains of Albar and UPA and (2) district variety tests are reported. Strain C(50)20 of BP52 was the most promising entry in (2), with an average yield increase of over 20% over S47. The new variety DE715/6M showed an increase over S47 in both the Northern and Eastern Provinces [cf. XXIX, 4098]. In contrast to DE715/6M, BC177 gave more

favourable yields in the Acholi, Lango and West Nile districts and a less favourable performance in the Bukedi area.

Republic of the Sudan. Cotton Breeding Stations. Progress report for the season 1957–58.

2902 *Rose, M. F., Hughes, L. C. & Low, A. The Gezira Research Station.* (*pp. 2–16*).

The results of breeding and testing were to a considerable extent spoiled by a very adverse season.

In work on Egyptian cotton, every effort is being made to incorporate B_6 into B_2B_3 and B_2 types, in view of the occurrence of a new virulent race of black arm in the Shambat region. Strains derived from Tangüis x BAR 14/25 displayed an interesting range in both yield and quality. Other material studied included: B_2B_3 Sakel x B_2B_3 Egyptian cotton of the L type, Pima S1 x BAR 14/25, B_2B_3 Sakel types carrying leaf-curl resistance and black-arm resistant Karnak (B_2B_3).

Of the work on American cotton, the following investigations may be mentioned. F_3 families from BAR 17/7 x Wilds SUS16/1 were subjected to detailed analysis with reference to the following main objectives: (1) transference of boll weight from Wilds to BAR 11/7 in an endeavour to boost yield while retaining the lint characteristics of BAR 11/7; (2) transference of "wilt" resistance from Wilds to BAR 11/7; and (3) transference of *Ramularia* resistance to the American type. The F_3 analysis also indicated that types are available combining the boll weight and lint length of Wilds with the "framework" of BAR 11/7. Breeding to combine the quality of BAR 11/7 with the yielding capacity of BAR 7/8.2 was initiated. Families developed in the project on the transference of intrinsic fibre strength from Hopi Acala to the commercial Kordofan varieties BAR 7/8 and BAR 11/7 were severely attacked by wilt. Careful analysis of the results suggested, however, that the families were higher in yield than the parent varieties.

2903 *Dark, S. O. S. & Saunders, J. H. Shambat Station.* (*pp. 16–24*).

Evidence has been obtained indicating that a new virulent strain of *Xanthomonas malvacearum* has arisen in the Shambat region [XXIX, 4105]. Two Sakel strains carrying $B_2B_3B_6$ and another with B_2B_6 were passed to Medani for testing. BAR 11/9, the first $B_2B_3B_6$ strain of a Pump Scheme Strain (PSS) derivative, was also sent to Medani. Transferences of B_2B_3, B_2B_6 and $B_2B_3B_6$ to Karnak, Pima S1 and Acala 4–42 are proceeding. Transference of B_2B_3 to BP52 has been completed. Synthesis of B_2B_6 and $B_2B_3B_6$ strains of Upland types derived from PSS and Wilds SUS 16 continued. In addition, b_2B_6 strains of standard varieties are being synthesized for use in rapid transferences of B_6. B_1, B_5 and B_7 are being imparted to *Gossypium hirsutum* stocks, for making homology tests. Investigation of genes for black-arm resistance transferred from *G. herbaceum* to Sakel continued.

In breeding for jassid resistance, families of hairy Sakels (B_2B_3) with satisfactory length and density of hair were selected. Since, however, it is known that poor quality often accompanies hairiness in Sakels and that hairiness may also allow the build-up of white fly and aphid populations, this project is to be shelved and the selected material stored. Basic studies on the genetics of hairiness are being continued.

In breeding for yield, lines with high numbers of locules per boll, as well as of ovules per locule, have developed and are to undergo test for yield and quality at Medani.

Comparative study of *G. anomalum* and *G. triphyllum* continued [cf. *loc. cit.*]. A programme on the production of synthetic allotetraploids from as many combinations of diploid species as possible was initiated, to facilitate (1) study of the genetical relationships between diploids and New World tetraploids and (2) possible transference of useful genes to commercial varieties. Observations on the F_2 of a cross between *G. sturtii* and *G. robinsonii* confirmed that these types are distinct species.

From the fourth back cross of the transference of high lint strength from *G. thurberi*, three families were raised by selfing plants from the top and bottom portion of the curve of distribution of the plants constituting the back-cross in question. In these three families, plants were again chosen from the parts of the distribution curves thought to correspond to the $AA : 2Aa : aa$ ratio for a postulated major gene transferred from *G. thurberi*, reinforcing the polygenic system controlling lint strength. Correlation between the strength value of last year's parent and the mean of its family was not very strong. Only *A* and *a*, not the groups *AA*, *Aa* and *aa*, could be differentiated.

Further breeding for leaf-curl resistance was carried out. It included continued work on transferring resistance from *G. hirsutum* to $B_2B_3B_6$ Sakel and Lambert.

2904 *Rose, M. F., Low, A. & Hannay, H. E. Kadugli Station.* (*pp. 24–30*).

The results of variety trials at Kordofan, Tozi and Yambio are reported.

2905 *Munro, J. M. Nyasaland. Progress report for the season 1957–58* (*pp. 1–18*).
Albar 637 is being multiplied to replace CLB [cf. XXIX, 4107]. Study of crosses involving Albar 49 and Albar 51 continued.

Northern Nigeria. Progress report for the season 1957–58.

2906 *King, H. E., Lawes, D. A. & Lee, B. J. S. Cotton breeding.* (*pp. 4–7*).
Progress is reported in the programme of re-selection of local stocks of Allen. Current results suggest that it will after all be possible to combine high lint yield with satisfactory lint length.
The blend of 26J substrains already chosen to go forward to the seed multiplication scheme as third wave 26J gave a lint yield averaging 6·5% higher than second wave 26J, this higher yield being accompanied by a slight further improvement in average halo length.
Work on panmixis and determination of extent of natural crossing continued.

2907 *Anthony, K. R. M., Ogborn, J. E. A. & Proctor, J. H. Aden Protectorate. Research Section, El Kod. Progress report for the season 1957–58.* (*pp. 1–19*).
Selection of BAR XL1 (first filter of BAR1730L from Sudan) continued. Propagation of the first bulked progenies from BAR XL1 for commercial use was initiated. Among the varieties tested, Wilds Early was notable for high yield. Further work was carried out on transferring resistance to Abyan root rot from Wilds Early to the X1730A type; a fairly high degree of resistance was present in back crosses to BAR XL1. Using the *G. arboreum* gene for red seedlings as marker, the amount of natural crossing proved to be normal.

2908 *Spence, J. R., Cave, C. T., Lake, E. B. & Charles, W. B. West Indies. Cotton Experiment Stations. Progress report for the season 1957–58.* (*pp. 1–16*).
Filtering of the main Sea-Island strains for resistance to *Fusarium* wilt continued. VH8, VH10 and BSI were subjected to further progeny-row selection in Antigua.

2909 **Thirty-Seventh Annual Report of the Indian Central Cotton Committee for the year ended 31st August, 1958** : Pp. 99.

Bombay
In the scheme for improving *Gossypium arboreum* for the Khandesh tract, Y1 again surpassed Virnar in fibre fineness and spinning capacity [cf. XXIX, 4112].
In work on Mathio, CJ73 was named Sanjay and released as a replacement of Pratap. A project to develop a variety superior to Sanjay in various respects and equal to it or Mathio local in earliness was initiated.
Work on Indo-American cottons developed by interspecific hybridization continued, with particular attention to resistance to pests and diseases and fibre strength and maturity. In trials, ISC67 was superior to 134–Co.2–M in yield and quality but inferior to 170–Co.2 in yield. Both the last mentioned varieties are in commercial cultivation [cf. XXIX, 4119]. Two black-arm resistant strains, 170–Co.2–2–126 and 170–Co.2–2–S–3, outyielded 170–Co.2 and the local improved strain of *G. herbaceum* but improvement in their spinning performance is required. ICS67–4, 68–G–4–11 and 68–33–2, with extra long staple and resistance to black arm and jassid, were also high yielding. In addition, many progenies at early stages of breeding, "derived from *inter se* and interspecific crosses involving *barbadense* types, perennial cottons and wild species" combined desirable economic characters with resistance to pests and diseases.
In work on *G. arboreum* at Akola, AK277 was noteworthy for its increase in lint yield over the control (197–3) and for exceeding the targets set by the scheme in halo length and ginning outturn.
Work on developing extra-long staple cotton for certain soils in North Gujerat under irrigated conditions was initiated at Talod in 1957.
Breeding American cotton at Achalpur has resulted in two strains, 0296–7 and 147, which are improvements over Buri 0394. Strain 147 has finer quality than Buri 0394, combined with high ginning outturn. In breeding for resistance to jassid and black arm, derivatives from 394 x 2196–4 and 0394 x SH–12–7 displayed resistance to the former while F_3 progenies from 6/6 x 0394 were highly resistant to the latter.
Tests in the scheme for the Parbhani district again singled out strain 4166 as superior to Daulat in yield. Trials in the project of improving the Verum type in the Aurangabad and Bhir districts revealed a number of strains as promising in various respects.
Material of diverse origin showed a high degree of wilt resistance at Poona.

Punjab
In work on American cotton for the south-eastern districts, 85F and AC88 gave a promising

performance against 216F and H14 in large-scale trials. They had a spinning capacity of respectively 35s and 37s HSC, that of H14 being 33s. DC109, an improved strain of Asiatic cotton, failed to maintain its promise as a high yielder but was again superior to M60–A2 in quality. Improvement of DC109 by reselection for yield and earliness is under way.

Trials in cultivators' fields, undertaken to test strains developed in the scheme on American cotton with extra long staple ($1\frac{1}{8}$ in. and over) at Abohar, confirmed the superiority of LL54 over the control 320F in yield of seed cotton. Pending data from mill tests, this strain is undergoing multiplication for eventual release.

In work on American cotton for the central and submontane areas, trials on government farms and cultivators' holdings showed J2 and J4 as comparing favourably with 320F in yield and quality.

Mysore

Breeding Upland has resulted in promising strains from crosses of MA5 with Tidewater and Express. In a trial against MA5, MCU1 and MCU2, the strains surpassed all three controls, while equalling MA5 in yield. In addition, two strains were earlier than MA5. Five of the strains have also compared favourably with MCU1 and MA5 in cultivators' tests.

In the scheme at Gadag to secure improvement over Laxmi, IHX–11, selected from material from Surat, was highly resistant to black arm, besides being slightly superior to Laxmi in ginning percentage and staple length. Crosses such as Laxmi x 7682, BC–168–CW x Laxmi and Laxmi x 134–CW were particularly promising in disease resistance and quality.

Three strains developed in the scheme on breeding American cotton for black-arm resistance were tested at Dharwar and Gadag with Laxmi as control. Strain 170–Co.2–22 proved to be the best, combining good yield, ginning outturn, halo length and black-arm resistance. Among the 121 reselections from interspecific derivatives such as 125–Co.2–18, 170–Co.2, XAB5 and 2196–4, tested in nonreplicated rows, ten merited further trial.

In work on Cambodia in the Bellary district, the promising strains 5110 and 5216 [cf. *loc. cit.*] were again tested.

In district trials carried out in the project on improvement of Westerns, 2–3–68 gave encouraging results, while in less advanced trials 3870–IV again gave a good performance.

In work on Kumpta at Bagalkot, progress was made towards finding a strain equal to Jayadhar in wilt resistance and ginning outturn but surpassing it in earliness, yield and other respects.

In further work on perennial cottons, centred at Dharwar, F_1 Co.4/B40 x Quebradinho gave good results as regards yield, ginning outturn and fibre quality. Eight F_1s of crosses having the perennial type YS or Mocó as one parent and a black-arm resistant interspecific derivative as the other were also promising. Of these, 170–Co.2 x YS was the best in respect of all the economic characters considered. Asiatic perennial types and their hybrids had good yielding capacity and desirable fibre strength but suffered from small-leaf disease when cultivated beyond two or three years.

Madras

The scheme on long-staple American cotton as a winter crop in central districts has resulted in 9030G, to be released as a substitute for MCU1, over which it has shown an all-round superiority. Promising strains have been developed in the project to produce an extra-long staple American cotton ($1\frac{3}{16}$ in.).

In work on Cambodia, 9030–G, the best strain in the irrigated tract, gave a somewhat higher yield than MCU1 and 9030–8–5 without irrigation, the possibility of having a common strain for both the irrigated and unirrigated area of Cambodia cultivation thus being envisaged. In the main strain trial, PK924 combined good quality and yield, with a count strength product of 2096 for nominal 40s as compared with 1798 in MCU1.

The new strain Karunganni 6 (Pandyan) [cf. 1739] maintained its improvement in yield in tests on cultivators' holdings.

Madhya Pradesh

Material meriting further study has been developed in the scheme to produce a strain of Asiatic cotton combining the yielding capacity of Maljari with the ginning percentage of Virnar for the Nimar tract. In work on American types, the superiority of the new strain A51–9 over Buri 0394 in yield, ginning outturn and halo length was confirmed. Of the several cottons from elsewhere in India which were tested as to suitability for the tract and possible use in crossing, 9030–8–5, 9030–G and 01545C from Coimbatore were promising.

Breeding of American cotton at Badnawar has the aim of a strain with a staple length not less than that of Indore 2 ($\frac{13}{16}$ in.) and superiority over this variety in ginning percentage, yield of seed cotton, quality and resistance to drought and jassid. In trials by cultivators CTI–4–21

yielded well, with a ginning outturn of 36·7% and fibre length of 1·06 in. In a trial under experimental conditions, CTI–4–21–14 and 4–25–4 each represented an improvement over Indore 2 in yield, ginning outturn and halo length, with a spinning capacity of 43–44s HSC as against 31s for Indore 2.
Progress was made in single-plant selection in cultivators' fields with a view to isolating an Asiatic strain for Malwa better than Bhoj or Jarila in yield and technological properties.

Rajasthan

Further trials continued the search for strains of American cotton superior to Indore 1 for irrigated conditions.

Andhra Pradesh

In the scheme on white-linted *G. arboreum* for the Northerns tract, two strains, 5975 and 122, surpassed N14 in yield, halo length and ginning outturn in cultivators' tests.
Work continued on developing a white-linted cotton for the Cocanadas tract and on improving Cambodia at Nandyal.

Uttar Pradesh

In the improvement of Asiatic cotton in the western and central districts, a derivative of 35/4 x Parb. G703 outyielded the control (35/1) in yield at five stations. In quality, 51/50 was the best, with 26s HSC as against 16s for 35/1. This strain is now undergoing reselection for yield. In the main trial of strains of American cotton, the following exceeded the control P216F in yield and halo length: P.Am./7 x Parb.Am./1, P.Am. x Express/2, P.Am. x Parb./9, P.Am. x Missdel/5, 100F x Parb. x 100F/8 and Iran 1/9 x P.Am./4.
Trials carried out on Government farms in the scheme on Asiatic cotton for the Rohilkhand Tarai area showed C520 x C402 and 35/4 x Parb.G.703 to be better in yield than 35/1. The second strain surpassed the other entries in quality. The main trial on Asiatic strains singled out 51/59 as superior to 35/1 in yield, ginning outturn and count strength product.

Assam

The project on the development of high-yielding strains of coarse short-stapled cotton with high ginning outturn continued, work being confined to trials.

Orissa

Further tests were carried out on commercial American cottons.

2910 Méndez R., E. D.
Resultados del mejoramiento del algodonero, campaña 1957–58. (**Results of cotton breeding, season 1957-58**).
Inf. mens. Estac. exp. agríc. La Molina 1959 : **33** : No. 380 : 1–9. (Mimeographed).

Dehiscent capsules from 241 artificially selfed varieties of *Gossypium herbaceum, G. arboreum, G. hirsutum* and *G. barbadense* have been collected. Selection for earliness and fibre yield continued in Tangüis progenies. Irregularities of growth and reproduction and varying degrees of mortality were observed in the progenies of seeds irradiated with X rays or thermal neutrons; plants with dehiscent capsules were found chiefly after treatment for 10 hours with thermal neutrons or after an X-ray dose of 25,000 r. Numerous intervarietal crosses are under study. Use of the gametocide FW–450 resulted in scorching of the leaves, delay in fruiting and, 4–6 weeks after treatment, nondehiscence of the anthers in 90–100% of the flowers, pollen sterility and a lower degree of female sterility. In trials of hybrid material, 2872–56, from U4 x Tangüis LMW467–45, gave significantly higher yields of fibre than other hybrids or the controls. Results of trials under conditions of wilt are also reported.

2911 Walker, J. T.
Some Uganda cotton varieties.
Emp. Cott. Gr. Rev. 1960 : **37** : 54–57.

Selection for lint yield within BP52 has resulted in a series of high-yielding lines [cf. XXIX, 4097]. The increase in yield, effected by means of a selection-index technique based upon yield components, has led to little change in lint quality. Mechanical mixtures of seed of the selected lines are distributed annually under the title of NC multiline issues, numbered according to the year of mixing and distribution. Data from eight trials in three seasons indicate that compared with BP52 local, NC strains (NC54, NC55 and NC56) are slightly shorter and finer, give stronger yarn and tend to have greater fibre maturity. Fluctuation in fibre and spinning properties due to interaction with season and environment appears to be less in the NC strains. Because of its pronounced tendency to neppiness, S47 (selection from BP50) is being replaced by three successive selections (DE) from BP50 x B181, the last of which, DE715/6M, is now the commercial seed issue. Although having slightly shorter staple than S47, the DE strains are superior to S47 in yield and some fibre and spinning properties. DE715/6M, in

particular, is relatively free from seedcoat nep. Selections of the blight-resistant type Albar are not yet grown commercially in Uganda. Albar bulk material showed a mean increase in lint yield of over 30%, compared with BP52 local in district trials. Recently selected strains are markedly superior in yield to the bulk but still retain much variability in fibre characters. In comparison with BP52 local, Albar bulk has a higher standard fibre weight and, as measured by the stelometer, weaker fibre strength, so that its yarn is weak. Although the standard fibre weight of Albar is greater than that of other cottons in Uganda, this is not necessarily a disadvantage; probably Albar could be successfully developed within a fairly short period as a variety with a staple length of $1\frac{1}{4}$ in. and standard fibre weight of about 200.

2912 WARE, J. O.
Inheritance of X-ray diffraction pattern and its correlation with other properties in upland cotton.
Agron. J. 1960 : **52** : 25–26.

An account is given of studies undertaken on the inheritance of lint X-ray diffraction pattern and its correlation with strength, fineness, upper half mean, lint index and seed index in the Upland cottons Florida Green Seed, which has short, coarse, strong lint with low X-ray angle, and Turner's C, which has weak lint with very wide X-ray angle.

Frequency distributions of X-ray angles in parental lines, F_1, F_2 and first and second back crosses to each parent were plotted, and inheritance was found to be quantitative. A significant negative correlation was found between X-ray angle and lint strength but not between X-ray angle and any of the other characters studied.

2913 KAMEL, S. A.-L.
Inheritance of fiber fineness in the interspecific hybrid *Gossypium hirsutum* x *G. barbadense*.
Diss. Abstr. 1959 : **20** : LC Card Mic 58–2845 : p. 3. (Abst.).

The parents and F_1–F_3 of *G. hirsutum* 'DPL15' x *G. barbadense* 'Sea Island' were analysed by means of the arealometer with respect to 'weight fineness' and the two major components of this property, viz. fibre-wall thickness and perimeter. The properties behaved as quantitative characters, although in all respects they were not typical of such characters. Abnormal segregates with extra fine and thin-walled fibres were encountered in the F_2 and F_3. Thickness and perimeter were not affected by dominance. No conclusion could be reached as to whether gene action was geometric or arithmetic. The parental mean difference for each property was controlled by a few pairs of genes. Transgressive segregates were found. High heritability values were obtained from F_2 data. Heritability as measured from correlation and regression of F_3 lines on their respective F_2 phenotypes was very high for thickness and weight fineness but relatively low for perimeter. Selection on an individual-plant basis in the F_2 was highly effective for the three characters, with the exception of large perimeter. The significant correlation found between thickness and perimeter was low. High positive and significant correlations were obtained for weight fineness with its two components. Desirable expressions of weight fineness could be reached through selection of one or both components.

2914 VARUNCJAN, I. S.
(Interspecific hybridization of cotton).
Agrobiologija (Agrobiology) 1959 : No. 2 : 304–13. [Russian].

A series of experiments on distant hybridization, in particular reports on interspecific hybridization of cotton summarized already [XXIX, 1761 and 1762], are discussed in relation to Lysenko's views on interspecific incompatibility. The author agrees with Lysenko's views that a hybrid between two different species cannot give stable fertile segregates combining characters from each parent species. Nevertheless, the value of interspecific hybridization as a breeding method, especially its role in shattering the heritable basis of a species, is recognized and it is thought that economically useful forms resembling one parent or possessing entirely new characteristics could be obtained by this means. It is however regarded as incorrect to describe such new forms as interspecific hybrids. In the author's view, the term interspecific hybrid can only apply to distant hybrids of such plants as potatoes, sugar cane, fruit trees and forest trees which are reproduced asexually and consequently give stable vegetative generations combining the characters of both parental species.

2915 BHATNAGAR, M. P., CHANDOLA, R. P. & SANGHI, A. K.
Some chemically induced variations in Upland cotton.
Sci. & Cult. 1959 : **25** : 143–44.

Using chemicals, an attempt to induce mutants characterized by early flowering, longer staple

or ♂ sterility is under way at the Government Agricultural Research Farm, Durgapura, Rajasthan. A floral variant of 320F is described which may prove to be genetic and which would facilitate emasculation, since its staminal column is separate from the style.

2916 Endrizzi, J. E.
Cytogenetics of four sets of twins in cotton.
J. Hered. 1959 : **50** : 222–26.

A twin was obtained from each of the following: (1) Z1951 (*Gossypium arboreum-thurberi-hirsutum* hybrid back crossed twice to *G. hirsutum*, with 24_{II} + chain of 3, *Yy* and *pp*) x 2B–1 (Coker 100 stock, with 24_{II} + homozygous translocation and *yy*); (2) Z1951 x Z1859 (*G. hirsutum-herbaceum* hexaploid back crossed twice to *G. hirsutum*, with 24_{II} + ring of 4, *yy* and *Pp*); (3) Texas 531 (*G. hirsutum* marker line, with 26_{II}, *yy*, *pp*, h_2h_2 and *nn*) x Z2261 (*G. arboreum-thurberi-hirsutum* hybrid back crossed several times to *G. hirsutum*, with 24_{II} + ring of 4, H_2h_2 and *Nn*); and (4) selfed seed of Z2320 (*G. hirsutum*, 26_{II}, R_1r_1 and Lc_1lc_1). All the twins were sexual in origin. Those from (1), (2) and (3) were diploid/diploid sets while the twin from (4) consisted of a diploid and haploid. Cytological and phenotypical evidence indicated that the twin from (1) arose from dual embryo sacs within a single ovule, whereas those from (2) and (3) were each derived from a single embryo sac. Probably the twin from (4) also originated from a single embryo sac. In the case of the $2n/n$ twin, it is assumed that one of the eggs was fertilized, developing into the $2n$ member, while the other egg was not fertilized but was stimulated to develop into the haploid. This haploid had an average of $0{\cdot}16_{II}$ per cell.

2917 Steyaert, R. L.
Quelques données sur la physiologie de la capsule du cotonnier (en vue de l'étude de la stigmatomycose). [**Some information on the physiology of cotton capsules (with regard to the study of stigmatomycosis)**].
Ann. Gembl. 1959 : **65** : 305–32.

An account of studies undertaken in 1938 on the sugar content of cotton capsules is now published in full for the first time with only minor modifications and an addendum. Significant varietal differences were found in the ten lines of the variety Triumph Big Boll, but no correlation was found between sugar content and resistance to stigmatomycoses caused by *Nematospora coryli* and *Ashbya gossypii*.

2918 **Progress report on the annual varietal and environmental study of fiber and spinning properties of cottons, 1958 crop.**
US Dep. Agric. 1959 : No. CR–41–59 : Pp. 89.

Tables are given indicating the results of tests on commercial varieties and experimental material grown in the USA during 1958 [cf. XXIX, 4136].

2919 Caramelli, J. E.
Espesor de la pared celular en fibra de algodón argentino. (**Thickness of the cell wall in Argentine cotton fibre**).
Idia 1959 : No. 144 : 15–18.

From technological data already published in Argentina, the thickness of the fibre wall is calculated for 11 cotton varieties in the years 1952–1955. The results indicate that variation due to environmental factors is greater than that caused by genetical factors.

2920 Bird, L. S. & Blackmon, C. W.
Response of cotton varieties to seed deterioration and the influence of seed treatment on deterioration.
Plant Dis. Reptr. 1959 : Suppl. 259: 228–32.

Varietal differences in seed deterioration have been measured and this is found to proceed at the slowest rate in Floyd 89, Delfos 9169 and Northern Star 11. It is suggested that this character may be hereditary and that selection for resistance to deterioration could be carried out. The variety Acala 1517c, which deteriorates most rapidly, also has the highest degree of seedling vigour, suggesting a negative correlation between these two characters.

2921 Last, F. T.
Leaf infection of cotton by *Xanthomonas malvacearum* (E.F.Sm.) Dowson.
Ann. appl. Biol. 1959 : **47** : 647–57.

When inoculated into the main veins by means of a fine needle, *X. malvacearum* spread more rapidly along the vascular tissue than into the mesophyll, the extent of its spread depending upon the inoculum concentration, age of the tissue and cotton variety. In tests on seedlings about 4–5 weeks old, the *B* genes in BAR derivatives of Domains Sakel and Upland fell into three groups as regards effectiveness. (1) In plants carrying B_3 or B_5 singly, the pathogen spread extensively along the veins and into the mesophyll of at least 50% of the leaves. (2)

In seedlings containing B_4, B_9, $B_2B_3B_{6m}$ or B_2B_{6m}, the mesophyll was not penetrated and the affected necrotic zone of the vein did not increase significantly after the host's initial reaction. (3) B_1, B_2, B_7, B_1B_3 and B_2B_3 conferred an intermediate degree of resistance, with an appreciable spread along the veins but little, if any, into the mesophyll, at least until the leaves were moribund. The results are compared with those obtained with other methods of inoculation, with reference to the nature of the resistance imparted by B_2, B_3 and B_{6m} singly or in combination.

2922 Thomson, N. J. & Basinski, J. J.
Note on blackarm in northern Australia.
Emp. Cott. Gr. Rev. 1960 : **37** : 30–31.

Data are given on the incidence of black arm among varieties of New World cottons at the Kimberley Research Station, after a severe outbreak of the disease during the 1958–59 season. They are of particular interest in that they were obtained in an environment where cotton has been introduced only recently. In *Gossypium barbadense*, only BAR varieties displayed resistance. Varieties carrying $B_2B_3B_6$ or B_2B_3 were practically immune while those containing only B_2 were partially susceptible.

2923 Maier, C. R.
Cultural and pathogenic variability of *Rhizoctonia solani* isolates from cotton-growing areas of New Mexico.
Plant Dis. Reptr. 1959 : **43** : 1063–66.

Ten New Mexican strains of *Rhizoctonia solani* (*Pellicularia filamentosa*) have been distinguished from isolates from cotton, on the basis of their cultural chracteristics.

Twenty-five isolates, representing the 10 strains, have been tested for their pathogenicity on cotton and a wide range from nonpathogenic to highly pathogenic has been found.

An increased knowledge of this highly variable fungus might lead to the discovery of effective control measures. It appears probable that its variability extends to response to treatment with various chemicals.

2924 Wilson, K. I.
Control of cotton anthracnose in Bombay State.
Poona agric. Coll. Mag. 1959 : **50** : 105–14.

No source of resistance to *Colletotrichum indicum* has so far been found among existing strains of *G. arboreum* and *G. herbaceum*.

2925 Smith, A. L. & Dick, J. B.
Inheritance of resistance to Fusarium wilt in Upland and Sea Island cottons as complicated by nematodes under field conditions.
Phytopathology 1960 : **50** : 44–48.

From studies involving the Upland *G. hirsutum* varieties Cook 307 and Hurleys Rowden and the Sea Island *G. barbadense* variety Seabrook, it is concluded that resistance to *Fusarium oxysporum* f. *vasinfectum* in Upland cottons is controlled by a major dominant gene together with modifying resistance genes and by further genes for resistance to *Meloidogyne incognita acrita*, since a part of wilt resistance can be attributed to resistance to root-knot nematodes. Two dominant genes behaving additively are suggested for wilt resistance in Seabrook; only one of these has been successfully transferred to Upland cotton.

(Protection of cotton, lucerne and maize from pests, diseases and weeds. Summary of work for 1955-56).
SojuzNIHI, Taškent 1959 : No. 5 : Pp. 194. [Russian].

2926 *Solov'eva, A. I.* (*Results of testing specimens of the world collection of cotton for resistance to* Verticillium *wilt*). (*pp. 142–61*).

On the basis of unpublished work carried out at Taškent in 1935–37, several wilt-resistant varieties were found, one of them being 36–M_2, which has served as the parent for a number of successful Soviet cottons such as S–460 and 108–F. New races of *V. dahliae* capable of attacking these resistant cottons later developed in certain areas. Among the varieties being grown, only OS–11 has proved highly resistant to the new race, while 147–F is somewhat less susceptible than 108–F. In 1955–56 tests were made of the cottons in the world collection and the results are tabulated, the cottons being arranged according to species. The highest resistance was found in cottons of *Gossypium barbadense*, the next being *G. arboreum*, whereas most cottons belonging to *G. hirsutum* and *G. herbaceum* were susceptible to the new race; the most resistant varieties are listed. Hybrids between *G. hirsutum* and resistant forms of *G. barbadense* were mostly resistant.

2927 Wickens, G. M. & Logan, C.
Fusarium wilt and root knot of cotton in Uganda.
Emp. Cott. Gr. Rev. 1960 : **37** : 15–25.

Observations on the susceptibility to *Fusarium*

oxysporum f. *vasinfectum* shown by commercial varieties grown in Uganda and Tanganyika, when infected (1) under natural field conditions in the presence of attack by root-knot nematode (*Meloidogyne incognita*) and (2) by artificial stem inoculation in the absence of root knot, were closely parallel. S47, hitherto the commercial variety in the Eastern Province of Uganda, proved to be most susceptible. This variety is now being replaced by BP52(NC) in Busoga district and by DE715/6M elsewhere. Both these replacements are relatively resistant. The degree of danger of infection by *F. oxysporum*, which was identified in Uganda in 1957, should therefore be reduced. Uk51 has also displayed some resistance and offers promise of yielding segregates with a measure of resistance likely to be valuable in Tanganyika. B181 appears to have been the parent conferring *Fusarium*-wilt resistance upon DE715/6M and BC177. Like B181, DE715/6M also possesses resistance to *Verticillium dahliae* and *Xanthomonas malvacearum* [cf. XXIX, 4096]. It is thought that any intensification of nematode infestation would probably lead to a breakdown in the high degree of field resistance to *Fusarium* wilt displayed by BP52, NC57 and DE715/6M in the experiments.

2928 Friederich, J. C.
(The preliminary results of flax variety trials in 1959, laid out and analysed in collaboration with the Varietal Research Institute for Agricultural Crops).
Meded. Ned. Alg. Keuringsdienst Landbouwzaden Aardappelpootgoed 1959 : **16** : 64–65.

Trial results for 22 varieties tested in the Netherlands are reported. Wiera, Diana, Engelum C16 and the new line CB1 were highest in yield of stems.

2929 Vezelvlas, 1960.
(Flax, 1960).
Landbouwvoorlichting 1960 : **17** : Bijl. 68; Ber. Rassenkeuze : No. 285 : Pp. 3; Vlugschr. Afdel. Vezelgewass. Proefsta. Acker- en Weidebouw No. 17.

Information on the performance of 12 varieties tested in the Netherlands is presented. Among the six new varieties included in preliminary tests, CB1 showed promise.

2930 Walles, B.
Phytotron studies on the viability of a chlorophyll mutant in flax.
Kungl. LantbrHögskolans Ann. 1959 : **25** : 261–68.

The light-green (*chlorina*) mutant Sv. 0800 is superior to the parent line Concurrent in southern Sweden.

Field tests, greenhouse tests and tests in which the climates of a northern and a southern district were simulated in growth chambers indicated that although the mutants show an initial retardation of growth, their final height and fresh and dry weight almost equal that of the parent. The chlorophyll content of the mutant was 60% of that of Concurrent.

2931 Flor, H. H.
Differential host range of the monocaryon and the dicaryons of a eu-autoecious rust.
Phytopathology 1959 : **49** : 794–95.

The pathogenicity of uredospores, sporidia and F_2 uredospores obtained by selfing pycnidiospores of race 210 of *Melampsora lini* was tested on 25 differential flax varieties. Bombay differed from the other varieties in being susceptible to the monocaryotic stage but immune from the dicaryotic stages of the parasite, resembling in this respect the alternate host of heterecious rusts.

2932 Colhoun, J.
Physiologic specialization in *Polyspora lini* Laff.
Trans. Brit. mycol. Soc. 1960 : **43** : 150–54.

Using the pot technique of testing flax resistance to the stem-break phase of the disease caused by *P. lini* [cf. 1776], races of the pathogen were identified. None of the varieties tested was immune to one race and susceptible to another so that separation of races was based upon the degree of attack on the differentials. Difficulty was encountered in maintaining isolates in artificial media for a year or longer without alterations in the degree of attack on at least some of the differential varieties.

2933 Arinštejn, A. I. & Pelipenko, A. I.
(The effect of crossing upon sex in hemp).
Agrobiologija (Agrobiology) 1959 : No. 2 : 298–301. [Russian].

Diecious types predominated over monecious types in the progeny from monecious hemp which had been pollinated by male plants of diecious hemp or male plants occurring as segregates in monecious hemp in experiments

at Gluhov, Ukraine. Hybrids from pollination of diecious hemp by the pollen of monecious hemp with a female habit were mostly normal female plants with also, however, a few normal male and monecious plants. Pollinating these hybrids with pollen of monecious hemp gave an increase of 41·8–45·1% of monecious types and a reduction of males. Controlled pollination of monecious and normal female plants with the pollen of monecious hemp resulted in a high percentage of monecious types among the hybrids and an absence of males. Diecious types predominated in the progeny of open pollinated monecious plants. Promising hybrids of monecious and diecious types have been selected.

2934 Bózner, M.
Využitie papierovej chromatografie k rozlišovaniu rôznych konopných odrôd v kyselých a zásaditých hydrolizátoch, resp. liehových výťažkoch z mladých rastliniek. (The utilization of paper chromatography for distinguishing different hemp varieties from acid and alkaline hydrolysates or from alcoholic extracts from young plants).
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 131–30.

It was found that analysis of sugar content by paper chromatography provides a reliable means of distinguishing varieties. The results of such analyses indicate that the hemps of Rastislavice belong to an indigenous Slovak variety which may have originated from an Italian variety. Analyses of aminoacid content gave similar results as regards distinguishing varieties.

2935 Ahmad Shamsul Islam & Rashid, A.
First successful hybrid between the two jute-yielding species, *Corchorus olitorius* L. (Tossa) x *C. capsularis* L. (White).
Nature, Lond. 1960 : **185** : 258–59.

In investigations at the Department of Botany and Plant Breeding, University of Sind, Hyderabad, the pedicels of the flowers, after pollination, were wrapped with cotton which had been soaked in 300 p.p.m. of indole-3-acetic acid. Of the 365 seeds obtained from 15 fruits in 115 crosses between *C. olitorius* ♀ x *C. capsularis* ♂, only 7 germinated, of which 3 reached the adult stage. No hybrids were secured from the reciprocal. In some characters *C. olitorius* was dominant, in others *C. capsularis* was dominant, while in a number of characters the hybrids were intermediate. Good seeds were obtained by selfing. All the 55 back crosses to *C. capsularis* failed; 120 back crosses to *C. olitorius* resulted in the formation of only 7 fruits. In the hybrids 7_{II} were regularly observed. It is not known whether cryptic structural hybridity was present.

2936 Sanyal, P. & Dutta, A. N.
Inheritance of petal colour and stigma colour in *Hibiscus cannabinus* Linn.
Sci. & Cult. 1959 : **25** : 145–48.

Yellow petals were dominant over white and dependent on a single gene (*Y*). Red stigma was dominant over white and monogenically inherited (*R*). No linkage was detected between *Rr* and *Yy*.

2937 Sanyal, P.
Studies on the pollen tube growth in six species of *Hibiscus* and their crosses *in vivo*.
Cytologia, Tokyo 1958 : **23** : 460–67.

No stylar incompatibility was shown in crosses in both directions between *H. cannabinus*, *H. sabdariffa* and *H. radiatus*. In reciprocal crosses involving (1) *H. lunariifolius*, *H. pandurae-formis* and *H. vitifolius* and (2) these three species and *H. cannabinus*, *H. sabdariffa* and *H. radiatus*, the pollen failed to germinate. Slight differences in rate of pollen-tube growth were noted among compatible interspecific matings.

2938 Menzel, M. Y. & Pate, J. B.
Chromosomes and crossing behavior of some species of *Sansevieria*.
Amer. J. Bot. 1960 : **47** : 230–38.

The species examined, numbering about 20 and represented by 28 clones, were diploids, tetraploids or hexaploids, 20 being considered to be the basic chromosome number. About 40% of the taxa were polyploid. Except for chromosome number, all the species were caryotypically similar. Hybrids were easily obtained from the intervarietal cross *S. trifasciata* x *S. trifasciata* var. *laurentii*, made in an attempt to combine the cold tolerance of the latter parent with the fibre content of the former. Field observations since 1952 have however suggested that selection among seedling clones of *S. trifasciata* for the desired combination of the two characters would be as effective as selection of the hybrids. Of the 12 crosses attempted between diploid species, five were successful, viz. crosses of *S. trifasciata* with *S. deserti*, *S. parva*, *S. aethiopica* and *S. ehrenbergii*, and *S. parva* with *S. deserti*. All these diploid hybrids have been at least partially fertile. Meiosis was examined, except in *S. trifasciata* x *S. ehrenbergii*. Each diploid

hybrid regularly formed 20_{II} at metaphase I. The *S. trifasciata* x *S. deserti* hybrids have exhibited considerable hybrid vigour. The back cross with *S. trifasciata* shows a wide range of types; the F_1 and possibly some of the back-cross phenotypes appear promising for fibre production in southern Florida. The *S. trifasciata* x *S. ehrenbergii* hybrids are still too young for evaluation but it is anticipated that they may be of practical interest. In the hybrids between *S. trifasciata* and *S. parva* or *S. aethiopica*, the dwarf habit of each of the latter two species was dominant. No hybrids were secured from crosses of diploid with polyploid species, except for two triploid individuals from *S. trifasciata* x (4*x*) *S. liberica*. These formed trivalents with a high frequency. In contrast, the frequency of multivalent association in polyploid species was variable but rather low. In an attempt to increase the fibre percentage of the *S. trifasciata* x *S. deserti* hybrids, they were crossed with *S. liberica*. None of the seeds germinated. More vigorous than the 2*x* hybrids, triploids of *S. trifasciata* x *S. deserti* have been obtained, presumably as the result of pollination of flowers of an autotetraploid sector of the parental *S. trifasciata* clone. They are sterile but could be propagated by leaf cuttings should they prove desirable for fibre production. It is postulated that the genus is monophyletic and that speciation has proceeded through genetic variation and hybridization at the diploid level, and by segmental allopolyploidy, without any marked degree of chromosome differentiation.

2939 Singh, S. N.
Studies in the sex-expression and sex-ratio in *Luffa* species.
Indian J. Hort. 1958 : **15** : 66–71.

Sex expression and sex ratio were studied in *L. acutangula*, *L. cylindrica* and their interspecific hybrid. Four sex forms were distinguished in *L. acutangula* but only monecious forms occurred in *L. cylindrica* and in the hybrid. The predominance of male over female flowers was marked in both species and in the hybrid, but considerable varietal differences were observed in the magnitude of the sex ratio.

2940 Narita, Y. & Ono, K.
(Histological studies on the inner bark of *Broussonetia*).
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1959 : **28** : 115–17. [Japanese].

Data are provided on the thickness of the epidermis, cork, phelloderm, cortex and fibre layers of two varieties of *B. kazinoki* and four of *B. papyrifera*.

SUGAR AND STARCH PLANTS

2941 Monzón Paiva, D. E. & Viso Rodríguez, A.
Determinación del tamaño óptimo de unidad experimental mediante la ley de la varianza de H. Fairfield Smith.
(Determination of the optimum size of an experimental unit by means of H. Fairfield Smith's variance law).
Agron. trop., Venezuela 1958 : **8** : 43–49.

On the basis of Fairfield Smith's law of variance [VIII, 1011] applied to a uniformity trial of sugar cane, it is calculated that, regardless of plot shape, the optimum plot size is approximately 100 m.^{2}; half or double this area may be used without appreciable reduction in efficiency.

2942 Grillot, G.
Les essais de canne à sucre au Maroc.
(Sugar-cane trials in Morocco).
Bull. Soc. Agric. Maroc 1957 : No. 77 : 21–29.

New attempts are being made to establish sugar-cane plantations in Morocco using the early, drought-resistant varieties POJ2725, POJ2727 and Co.290 and the moderately early TUC1376. Varieties resistant to relatively low temperatures are also being sought.

2943 Lee, S.
Report of some experiments on the germination of true sugarcane seed.
Taiwan Sug. 1959 : **6** : No. 10 : 23–32.

The author reports investigations undertaken in connexion with breeding at the Pingtung station, Taiwan, to study mainly the effects of two factors upon germination of hybrid seeds: (1) stage of seed maturity and (2) storage conditions. Seeds harvested 30–35 days after pollination germinated most satisfactorily when sown shortly after harvesting. Storage in a desiccator with the drying agent Riken Adosole at — 4 to — 5° C. offered a satisfactory method of keeping seed for over two years.

2944 Li, H. W., Shang, K. C., Hsiao, Y. Y. & Yang, P. C.
Cytological studies of sugarcane and its relative. XV. Basic chromosome number of *Saccharum officinarum* L.
Cytologia, Tokyo 1959 : **24** : 220–36.

Cytological observations are reported from

Taiwan on (1) clone SG310/6 [BC_1 of *S. officinarum* ($2n = 80$) x *Sclerostachya fusca* ($2n = 30$)], (2) clone SG363/4 (SG310/6 x *Sclerostachya fusca*) and (3) SG363/4 back crossed with *Narenga porphyrocoma*. Clones (1) and (2) were first introduced from the USA into India and thence into Taiwan. SG310/6 had 72 chromosomes, 42 of which were derived from sugar cane and the remaining 30 from *Sclerostachya*. Many of the PMCs had 36_{II}, with complete autosyndesis. The larger closed type of bivalent of *Sclerostachya* could be easily distinguished from the smaller open type of *S. officinarum*. One or two quadrivalents were noted among the sugar-cane chromosomes. SG363/4 has $2n = 50$, 25_{II} usually being seen which were also completely autosyndetic. One quadrivalent was occasionally observed among the sugar-cane chromosomes. Fourteen of the 15 plants of (3) had $2n = 40$, the remaining one having 63. Pairing between the chromosomes of *Narenga* and *Sclerostachya* was almost perfect, 15_{II} of the closed type being formed. The 10 sugar-cane chromosomes remained as univalents or $1–4_{II}$ of the open type. As many as 4_{III} were found; 4 sugar-cane chromosomes were therefore partially homologous with 4 *Sclerostachya* or *Narenga* chromosomes. Occasionally 2_{IV} each involving 2 sugar-cane chromosomes, were seen. It is therefore conjectured that the 10 sugar-cane chromosomes in the BC_3 were probably made up of two sets of 5, four chromosomes of one set being partially homologous with four in the other. At least 4 chromosomes of one set of 5 are partially homologous with those from either *Sclerostachya* or *Narenga*. Probably *S. officinarum* with $2n = 80$ arose through hybridization between two unidentified species with $n = 5$, autopolyploidization and consequent segmental allopolyploidy, and further autopolyploidization, twice in succession.

2945 Sharma, S. L. & Shrivastava, B. B.
Bud mutation in B.O.11.
Indian J. Sugarcane Res. 1957 : **1** : 230–31.

A difference in pigmentation along half the length of one side of a cane of the above variety, apparently due to mutation, is described.

2946 V, L. G.
Four new varieties—Q.69, Q.71, Q.72, Q.73.
Cane Gr. quart. Bull. 1960 : **23** : 92–94.
Four new "Q" canes.
Aust. Sug. J. 1959 : **51** : 665–67.

Descriptions are given of four sugar canes released in Queensland. Q69 (Co. 281 x CP29–116) and Q72 (Co. 281 x POJ2878), both developed at Bundaberg, are expected to be especially useful on droughty soils in the Isis area. Q69 is resistant to downy mildew. Q71 (Co. 270 x POJ2787) is adapted to a wide range of soil conditions in southern Queensland, although it lodges on rich land and is low in vigour on dry, poor soils. It appears to be highly resistant to mosaic. Q73 (Trojan x Eros) is expected to find a place on the better forest soils of the central district and to a large extent replace Q57 where flooding and bacterial mottle are problems. It has also displayed resistance to leaf scale, gumming diseases, mosaic and red rot.

2947 **Growing better sugarcane. Part I.**
World Fmg., Kansas City 1959 : **1** : No. 9 : 25–28.

Mention is made of studies carried out by the US Department of Agriculture on wild and domesticated canes from all parts of the world, with a view to developing improved new varieties for temperate regions. A map is included illustrating the putative migrations of domesticated canes from their postulated origin in New Guinea.

2948 Price, S.
Cytological studies in *Saccharum* and allied genera. V. Chromosome numbers in *Saccharum*, *Erianthus*, *Narenga*, and *Sclerostachya* from Thailand and Vietnam.
Cytologia, Tokyo 1959 : **24** : 342–47.

The predominant chromosome number in seedlings of *S. spontaneum* from Thailand was $2n = 80$. Other numbers were $2n = 77$, 78, 88, 94 and 96. Seedlings of this species from Vietnam all had $2n = 80$. *E. arundinaceus*, *N. porphyrocoma* and *Sclerostachya* spp. from Thailand and *E. bengalense* from Vietnam had $2n = 60$, 30, 30 and 60 respectively.

2949 Moriya, A.
Cytological basis of the sugarcane breeding in the Far East, especially in Taiwan.
Utsunomiya Daigaku Nogakubu Gakujutsu Hokoku Tokushu/Spec. Bull. Coll. Agric. Utsunomiya Univ. 1959 : No. 6 : Pp. 63.

Cytological studies of wild and cultivated *Saccharum* species are described and the great variability of chromosome numbers within and between species is discussed with reference to plant improvement. A brief historical review of sugar-cane breeding in the Far East [cf.

XXIII, 511] is followed by a detailed account of hybrid varieties developed in Taiwan [cf. XXIV, 1290]. Sugar-cane sorghum hybrids are also discussed.

Beiträge zur Rübenforschung. Nr. 2. (**Contributions on beet research. No. 2**).
Wiss. Abh. dtsch. Akad. LandwWiss. Berlin 1959 : No. 38 : Pp. 90.

The second issue [cf. XXIX, 2774–7] contains the following contributions of interest to plant breeders.

2950 *Heinisch, O. & Böhme, L. Zur Frage einer korrelativen Beziehung zwischen der Anzahl der Gefässbündelringe und dem prozentualen Trockensubstanzgehalt bei Beta-Rüben.* (*The question of the correlation between the number of rings of vascular bundles and the percentage dry-matter content of beets*). (*pp. 7–37*).

Observations were made on 19,000 roots, comprising various cultivars of sugar beet and mangel and a number of hybrids. The correlation coefficients between number of bundle rings and dry-matter percentage varied between $r = 0{\cdot}641$ and $r = 0{\cdot}735$ in different years in mixtures comprising sugar beets, mangels and fodder sugar beets. However, within fodder sugar beets themselves the correlation was only $r = 0{\cdot}051$–$0{\cdot}261$ and within the sugar beets and the mangels the correlations were negligible and in certain very homogeneous varieties were even negative. Even in mixtures of sugar beets and mangels the values were rarely significant. Thus the correlation is of value for selection only when the differences are greater than those normally existing between the individuals within a variety, except in certain Kleinwanzleben breeding families, where somewhat higher correlations were observed, varying from $r = 0{\cdot}163$ to $0{\cdot}256$. The F_1 families from crosses between two homogeneous varieties showed little or no increase in the size of the correlation.

Considerable variation was detected from year to year both in the absolute values and the correlations. Moreover, determinations on mature roots and on roots lifted at various times during the first year of growth often gave different values; in general the correlations were higher when based on values in the mature roots. Although the correlation coefficients were distinctly higher when the density of rings (= number of bundle rings/root diameter) was used in place of the actual ring number, the values were still too low to be of any use in selection.

In comparing sugar beets and mangels it was found that the values for numbers of bundle rings often overlapped but those for dry-matter content rarely did so.

2951 *Staude, H. Abgekürzte Berechnung des Standardfehlers des Mittels bei zahlreichen kleinen Stichproben.* (*Rapid calculation of the standard deviation of the mean with numerous small samples*). (*pp. 51–61*).

The simplified methods proposed by Behrens [XXVII, 7] have been tested on the yield figures for a number of sugar-beet families and found more satisfactory than an earlier method proposed by M. Moldenhauer. Though the calculations based on the range are easier than those based on $\Sigma|x_i - \bar{x}|$, the latter method is preferred because it is possible to check the calculations.

2952 *Eichholz, W. & Bachmann, L. Versuche zur Ertragssteigerung im Rübenbau durch Jarowisation des Saatgutes.* (*Experiments on raising the yield of beet by vernalization of the seed*). (*pp. 62–73*).

In consequence of the breeding of varieties free from bolting, sugar beet can be sown 2–3 weeks earlier, but for this purpose varieties that germinate at about + 3° C. are required. Failing these, seed treatment is necessary and the present investigations were designed to test the effect of various treatments. When the seed was washed with running water for 9 hr. and germinated at 18–22° C., the seedlings being subjected to vernalization at + 2° C. for 8 days, earlier germination and significant yield increases were obtained in sugar beets such as Kleinwanzleben E; the effect on N varieties was less pronounced and none was obtained with the mangel Rote Walze [Red Cylinder]. Similar results were produced when the seed was treated with water without subsequent low temperature vernalization.

2953 Brykczyński, J.
O wielkości pólka w doświadczeniach odmianowych. (**On the size of plots in variety experiments**).
Hodowla Roślin Aklimatyz. Nasiennictwo 1957 : **1** : 757–61.

Figures are given showing percentage errors in determinations of root yield and sugar content in sugar beets from samples of 50, 100 and 200 roots respectively. By reducing the sample from 100 to 50 the error for sugar content was raised from 0·20 to 0·28% and that for root yield from 4 to 5·6%. The former is within the accepted limit but the latter exceeds it and is not considered advisable.

Institut International de Recherches Betteravières 21st Winter Congress. Report. Brussels 1958 : Pp. 266.

In the first half of this report all the papers are given in French; in the second half the English versions are given.

2954 *Schlösser, L.-A. Germination of beta-beets at low temperatures.* (*pp. 185–88*).

Data on the germination of six families of élites at 6° C. and 9° C. and of four of these at at 12° C. are presented. Germination normally takes place after 7–14 days at 9° C. and occurs much less readily at 6° C. Ability to germinate at the lower temperature may be improved by family selection in material which germinates at 9° C., or by partial or complete inbreeding of selected plants which have proved able to germinate at 6° C. With the latter method, complete inbreeding has led to increases from 2 to 11% and 4 to 23% in percentage of plants germinating at 6° C. It is noted that polyploid families generally germinate less well than diploid at low temperatures, triploid seed being better than tetraploid.

2955 *Filutowicz, A. & Byszewski, S. Experiments on the seed of polyploid sugar beet varieties.* (*pp. 189–97*).

Data on the root yield, sugar percentage, sugar yield, incidence of *Cercospora*, percentage of bolters and, for seven sieve fractions ranging from 2 to >5 mm., seed weight, number of seed balls per g., numbers of seedlings per g. and numbers of seedlings per 100 seed balls, are given for four diploid and four tetraploid varieties. One of the diploids and one of the tetraploids were monogerm. One tetraploid, based on a male-sterile line, had $3x$ and $4x$ seed only, while the others had $2x$, $3x$ and $4x$.

2956 *Campbell, G. K. G. Study tour in the U.S.S.R.* (*pp. 239–42*).

Observations on sugar-beet breeding in the USSR include the following. Many breeders are making single-plant selections the basis of new varieties while others are using methods involving vegetative hybridization. One method of selection for resistance to bolting is based on varietal response to additional light and to seed vernalization, separately and in combination. Another method depends on the observation of the distribution of bolting, flowering and fruiting during the normal second year of the life of seeding plants. Breeding projects include the development of monogerm beet and selection for disease resistance.

2957 *Siwicki, S. Effect of the varietal character on the results of manual and mechanical harvesting of sugar beet.* (*pp. 243–58*).

Experiments conducted in Poland on different methods of topping and lifting showed that, of the four varieties studied, the EE variety IHAR–K was best suited both to mechanical and manual lifting. It has short smooth roots to which soil does not cling and their rather soft texture resists mechanical damage.

2958 *Kuzdowicz, A. Determination of the polyploid degree in sugar beet by the number of pores in the pollen.* (*pp. 259–61*).

Details of the numbers of pores in the intine of pollen grains of diploids, triploids and tetraploids have already been summarized [XXIX, 1681]. In addition, data on pollen-grain size are given, tetraploids having distinctly larger grains than diploids while those of triploids are intermediate and highly variable. The variability of the triploids is attributed to unequal chromosome distribution. In the discussion following the paper, a method for the field identification of polyploids based on this technique is described.

Institut International de Recherches Betteravières. 22nd Winter Congress. Report. Brussels 1959 : Pp. 509.

Each paper presented at this congress is given in French in the first half of the report and in English in the second half.

2959 *Rietberg, H. Virus yellows of sugar beet and its control.* (*pp. 269–311*).

In this review, a short chapter deals with breeding for tolerance at Bergen-op-Zoom, Netherlands. Selection based on reduction of the depression in yield caused by the virus has proved more satisfactory than that based on the occurrence of yellowing. The use of chemical tests as indicators of the reaction in the leaves has also proved a good aid to selection. So far, it appears that tolerance depends largely upon multiple alleles, but there are also indications that a cytoplasmic factor may be involved.

2960 *Müller, A. v. The statistical evaluation of a long term series of sugar beet trials with the object of reducing the trial area.* (*pp. 427–30*).

An analysis of the results of five years' trials of 25 varieties in 15 localities in Western Germany, using six replications with 150 beets each, showed that varietal differences were pronounced and that the interaction varieties/localities was

very much smaller than the interaction varieties/years. It was also found that the use of two or three fewer replications would not seriously influence the final result.

2961 *Filutowicz, A. & Kuzdowicz, A. Viable hybrids between sugar beet and* Beta patellaris. (*pp. 433–36*).
[Cf. 624].

2962 *Ellerton, S. & Hendriksen, A. J. T. Note on the probable cause of the occurrence of tetraploid plants in commercial triploid varieties of sugar beet.* (*pp. 439–43*).
[Cf. 1796].

2963 *Brewbaker, H. E. Natural monogerm seed in the United States.* (*pp. 499–500*).
The work of the Great Western Sugar Company, USA, has resulted in the development of commercial monogerm varieties, in which the monogerm character is associated with a slight increase in sugar content. The varieties are developed by back crossing, and so far the production of monogerm F_1 hybrids has not been feasible.

Konferencja Zadkładu Buraka i Innych Roślin Koreniowych IHAR w Bydgoszczy—w 1958 r. (**Conference of the Section of Beet and other Root Crops of the Institute of Breeding and Acclimatization at Bydgoszcz in 1958**).
Biul. Inst. Hodowl. Aklimatyz. Roślin 1959 : No. 2–3 : Pp. 148.
The following contributions dealt with plant breeding.

2964 *Filutowicz, A. Hodowla odmian buraka cukrowego o owocach jednonasiennych.* (*Breeding monogerm varieties of sugar beet*). (*pp. 11–16*).
A review is given of work published in the USSR and the USA. Figures for segregation of the monogerm character and for earliness obtained in Polish experiments at Bydgoszcz are compared with those published by Savitsky in the USA; both show a strong correlation between late flowering and monogerm type, from which it is concluded that the gene for the monogerm character is identical wherever it is found; it is referred to as locus *m*, belonging to the same linkage group as genes for sugar content, yield, resistance to curly top and *Cercospora* and various other economic characters.
The first monogerm plant was found at Bydgoszcz in 1947 in the variety CLR. It was crossed with the multigerm PZHR–4 and in the F_2 some 25% of the seedlings were monogerm. Selection for monogerm habit continued until 1950, when the selections were crossed with superior varieties and also treated with colchicine; the 20 best plants were selected in the C_2 in 1953 and the seedlings grown in 1954; they were all low in sugar content and had to be crossed with superior multigerm varieties; the seedlings were crossed with a diploid with coloured hypocotyls and gave a population consisting of 75–80% triploids. The variety produced in this way, named Poly-MonoIHAR, in comparisons with the leading varieties in 1958 showed itself equal to them in yield of sugar per ha., being superior in yield though lower in sugar content (17·24%).

2965 *Kuždowicz, A. Możliwości wykorzystania niektórych dzikich gatunków rodzaju* Beta *w hodowli buraka cukrowego.* (*Possibilities of using some wild species of* Beta *in sugar beet breeding*). (*pp. 17–25*).
An account is given of some of the interspecific crosses that have been reported in the literature, from which it emerges that crosses between species within the section *Vulgares* are relatively easy to make, are fertile and have given rise to some useful varieties, particularly those resistant to *Cercospora*; among these the Polish variety CLR is cited as an example. In the section *Corollinae* crosses of sugar beet with *B. trigyna* have been carried as far as the F_5 at Bydgoszcz; the F_1 is sterile and must be pollinated with sugar beet; the F_2 shows segregation into sugar-beet types, intermediates and types resembling *B. trigyna*, all of which have the diploid chromosome number $2n = 18$. By selection in the succeeding generations, fertile groups with regular meiosis have been established in all three types. Their polarization figures vary from 16 to 18% and some of them are resistant to *Cercospora*.
Hybrids from a tetraploid sugar beet crossed with *B. lomatogona* have been produced and a natural hybrid is also under observation. All the hybrids have $2n = 36$, regular meiosis and monogerm seed.
Both diploid and tetraploid sugar beets have been pollinated with *B. patellaris*. The former gave hybrids with $2n = 27$ and at meiosis formed $9_{II} + 9_I$, resulting in complete sterility. Two hybrids were obtained from pollinating the tetraploid and both had $2n = 36$; although meiosis was regular, with 18 bivalents, the pollen was partially sterile. Crosses have also been made with *B. procumbens* from section *Patellares*; this species has been found to be exclusively

cross fertilized; hybrids were obtained only from diploid sugar beets and they showed various growth anomalies.

2966 *Korohoda, J. Wyniki prac nad podwójnymi mieszańcami buraków (cukrowe x półcukrowe białe) x (cukrowe x walcowate żółte) prowadzonych w latach 1933–1958.* [*Double beet hybrids (sugar beet x white semisugar) x (sugar beet x cylindrical yellow beet) carried out in 1933–1958*]. (*pp. 27–37*).

It is pointed out that present-day varieties of sugar beet and mangels yield up to 70 c. per ha. of sugar and of dry matter respectively. In attempts to raise these levels two crosses of Kleinwanzleben sugar beet were made in 1933, one with Półcukrowy Biały [White Semisugar] and one with the mangel Walcowaty Żółty [Yellow Cylindrical], the same mother beet, divided in two, being used for each cross. The root weight of the F_1 seedlings from the first cross varied from 600 to 1200 g. and that of the second cross from 800 to 1500 g., compared with 480 g. for the seed parent; the sugar content of the first cross was 14–15·5% and that of the second 13–14·5%, compared with 19·8% in the mother beet. The best of the white roots were sown in 1935 and intercrossed, the F_1 of these crosses being sown in 1936 and the F_2 in 1938; segregation was observed in the F_2 and the roots were arranged in 24 groups according to sugar content, each group comprising 4 plants, the seed of which was harvested separately. The seed was sown in 1941 and the roots were selected for shape, weight, sugar percentage, colour, leaf characters and resistance to *Cercospora*; 8 groups of 10 plants each were selected in 1942 and the seed sown in 1943. The mean values were root weight 850 g., sugar content 19·4% and sugar yield 104·90 g. and in 1945 the 20 best groups were again selected and the seed grown in isolation in 1946. The results of comparative tests carried out in 1947 are presented. Some of the lines proved equal to the control variety AJ–1 in sugar yield, line 30 being selected as the most promising. Further selection was carried out and in 1950–54 the mean values were: root weight 950 g., sugar content 20·5% and sugar yield 194·75 g. After further selection the best lines, tested in 1957, were 474% above the original sugar-beet parent in root weight; their sugar content remained the same or 1·5–5·9% lower, so that the yield of sugar per root was 382% greater than the sugar-beet parent; even the poorest lines yielded 68% more sugar than the sugar-beet parent.

2967 Hayashi, S. & Akita, K.
(On growing a spring crop of sugar beet in warm regions).
Hyogo Noko Daigaku Kenkyu Hokoku : Nogaku Hen/Sci. Rep. Hyogo Univ. Agric. : Ser. Agric. 1958 : **3** : 131–36. [Japanese].

A comparative trial of three GW varieties from the USA and the Japanese variety Honiku 192 at Kakogawa showed the great superiority of the former in respect of root weight under these conditions.

2968 Siwicki, S.
Wpływ właściwości odmian na wyniki ręcznego i mechanicznego sprzętu buraków cukrowych. (**The influence of varietal characteristics on the results of hand and mechanical harvesting of sugar beets**).
Roczn. Nauk rol. : Ser. A 1959 : **80** : 93–131.

The suitability of four different sugar-beet types for various methods of harvesting was investigated in Poland in 1955–56. IHAR–K, a tonnage variety with short, smooth roots to which the soil did not cling, was best for mechanical harvesting. Sugar losses in roots remaining in the soil after topping were less in tonnage varieties than in high-sugar varieties.

2969 Tiščenko, A. V.
(Intervarietal crossing of sugar beet).
Agrobiologija (Agrobiology) 1959 : No. 2 : 296–98. [Russian].

The effects of intervarietal hybridization upon seed production and root and sugar yields were studied at Poltava in hybrids of the following types (1) tonnage x tonnage, (2) tonnage x Z and (3) Z x Z. In (1) the hybrid was more productive of seed that the parent varieties but did not differ noticeably in root or sugar yield. The hybrids from (2) showed improvements in seed, root and sugar yields by comparison with the parents, while hybrids from (3) were in no way superior to their parents.

2970 Mazlumov, A. L.
Învățătura miciurinistă, baza succeselor în ameliorarea sfeclei de zahăr. (**Mičurinist science, the basis of success in breeding sugar beet**).
An. Romîno-Soviet. : Ser. Agric.-Zooteh. 1959 : **13** : No. 1 : 50–58.

[Cf. XXIX, 4208].

2971 Donà dalle Rose, A.
Nessun effetto di "prefioritura" in F_1 di piante trattate con acido gibberellico. **(No effect of bolting in F_1 of plants treated with gibberellic acid).**
Agricoltura d. Venezie 1960 : **14** : 89–90.
Plants of sugar beet grown from seed produced by plants in which flowering had been stimulated the previous year by gibberellic acid showed no signs of increased tendency to bolting when compared with the progeny of untreated controls.

2972 Rasmusson, K.
Naturligt och artificiellt enkornfrö och dess användning inom sockerbetsodlingen. **(Natural and artificial monogerm seed and its use in sugar-beet production).**
K. Skogs- o. Lantbruksakad. Tidskr. 1959 : **98** : 225–38.
The advantages of monogerm material, whether produced by mechanical rubbing and grading or genetically fixed, are noted. American monogerm varieties are being crossed with European multigerm varieties with the aim of developing monogerm material for Sweden.

2973 Trzebiński, J. & Gniłka, W.
Metody oceny jakości technologicznej buraka cukrowego. **(Methods of determining the technological quality of sugar beet).**
Hodowla Roślin Aklimatyz. Nasiennictwo 1959 : **3** : 381–92.
Various techniques are surveyed and a simplification of the method used at the Institute of Plant Breeding and Acclimatization is proposed. The modification involves the determination of the ash in the pulp rather than in the digested juice. The results obtained are in good agreement with those of the previous method, and the method has the advantage that less material is required so that it may be used in single-plant selection.

2974 Gooding, H. J.
West Indian *Dioscorea alata* cultivars.
Trop. Agriculture, Trin. 1960 : **37** : 11–30.
Sixteen yam cultivars are distinguished on foliage and tuber characters and a key for their identification is presented along with their vernacular synonyms in six West Indian islands. Nonpigmented yams show better keeping quality than pigmented forms and, of the former, the Lisbon group ranks highest. The cultivars described are relatively free of disease and many are high yielding. Infertility is common.

STIMULANTS

2975 Matzinger, D. F., Mann, T. J. & Robinson, H. F.
Genetic variability in flue-cured varieties of *Nicotiana tabacum*. I Hicks broadleaf x Coker 139.
Agron. J. 1960 : **52** : 8–11.
"Estimates of additive genetic, dominance and additive x additive epistatic variances were obtained from a cross between two tobacco varieties. Very little heterosis was observed for any of the characters studied. Estimates of components of variance larger than their standard errors were obtained for (1) additive genetic variance from yield, value per cwt., plant height, number of leaves, leaf width, nicotine content and total alkaloid content; (2) dominance variance from value per cwt., number of leaves and number of suckers; and (3) additive x additive epistatic variance from plant height and leaf length.
"By selecting the highest yielding 5% of the full-sib families and intercrossing these families, the predicted gain in yield for the next generation was 7% above the average of the full-sib families. By selection of the top 5% of the F_3 families the expected gain was 11% above the mean of the F_3 families. A genetic correlation between yield and nicotine content of — 0·54 indicated that 5% selection of the full-sib families for yield would be expected to decrease nicotine from 2·54% to 2·36%."

2976 Izard, C.
Contribution à l'étude des pigments du genre *Nicotiana*. **(Contribution to the study of the pigments of *Nicotiana*).**
CR Acad. Sci., Paris 1959 : **249** : 2226–28.
From an analysis of the anthocyanidin-forming capacities of the subgenera *Rustica*, *Tabacum* and *Petunioides*, it is concluded that, while the subgenus *Tabacum* is characterized by the ability to synthesize cyanidin, the pigmented species of *Rustica* and *Petunioides* produce mainly delphinidin; only species in the section *Alatae* of *Petunioides* and *N. megalosiphon* in section *Suaveolentes* in *Petunioides* regularly contain some traces of cyanidin. Among some 30 interspecific hybrids studied, all those with a genome from *N. tabacum* (section *Genuinae*, subgenus *Tabacum*) synthesized either cyanidin or cyanidin with traces of delphinidin, while all those without this genome synthesized either

delphinidin or delphinidin with traces of cyanidin. One hybrid of the last group, *N. glutinosa* x *N. sylvestris*, was exceptional in producing mainly cyanidin. *N. glutinosa* pertains to section *Tomentosae*, subgenus *Tabacum*, and synthesizes cyanidin with traces of delphinidin, while *N. sylvestris* is a colourless member of the *Petunioides*. It is suggested that *N. sylvestris*, which has certain similarities to the subgenus *Tabacum*, be removed from the section *Alatae* and placed in a new section, *Sylvestrae*.

2977 Oka, M.
(An analysis of the inheritance of quantitative characters in a diallel cross of tobacco varieties of the yellow type).
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 87–92. [Japanese].

A diallel cross involving six American flue-cured varieties was made, the characters studied comprising leaf number, flowering period, plant height and leaf shape. Estimates of D, F, H_1, H_2, h_2 and E were calculated for each character. From these it was inferred that the above characters were determined by few (three or less) partially dominant genes. Heritabilities were high (0·51–0·76).

2978 Moav, R. & Cameron, D. R.
Genetic instability in *Nicotiana* hybrids. I. The expression of instability in *N. tabacum* x *N. plumbaginifolia*.
Amer. J. Bot. 1960 : **47** : 87–93.

Five genes from *N. plumbaginifolia* (pbg) which behave as dominants in an appropriate *N. tabacum* (tbc) background were studied with respect to their somatic instability in hybrids representing various degrees of polyploidy and different genome ratios, as well as in back crosses. The five pbg genes were: *Wh* and *Tg* for flower colour; *Ws* for chlorophyll production; *Kl* for pollen abortion; and *Bs* for blackshank resistance. All five genes showed instability. The observations indicated that the instability was due to interactions between individual pbg chromosomes and the tbc genomes and that it involved losses of whole chromosomes. It is postulated that probably all or most of the chromosomes in the pbg genomes are unstable when incorporated into a *N. tabacum* nucleus, and that the genetic mechanism of instability detected in the tbc–pbg combinations may be of fairly wide occurrence in hybrids between distantly related species, not only in *Nicotiana* but also among other plants.

2979 Smith, H. H. & Daly, K.
Discrete populations derived by interspecific hybridization and selection in *Nicotiana*.
Evolution, NY 1959 : **13** : 476–87.

An analysis was made of diploid and amphidiploid *N. langsdorffii* x *N. sanderae*, maintained by selfing and selected on the basis of single plants having small, intermediate and large corolla tubes. With respect to the selected character, the diploid lines were as uniform as the parental lines by the F_6. But in the F_9 and F_{10}, the diploid line selected for large flowers showed a significant advance, exceeding the size of the larger parent. The amphidiploid lines remained highly variable and showed relatively less response to selection. Investigation of reproductive isolation as indicated by crossability, frequency of meiotic irregularities and pollen abortion showed that each selected line was isolated from its parent on the basis of at least one of these criteria. The diploid line most strongly isolated, i.e. the small-flowered one, was as isolated from both parents as the parents were from each other, except according to one criterion. Amount of pollen abortion in back crosses of the amphidiploid lines to the parental species was about the same as in back crosses of the diploid lines. Measurements were made on ten unselected characters in the F_9, five of which were floral and five vegetative. On the basis of corolla-tube size, the means were separable into six significantly different groups, which overlapped less frequently in the case of the vegetative characters.

2980 Georgiev, H. D.
(An instance of form development in tobacco).
Izv. bot. Inst. (Bull. bot. Inst.), Sofija 1956 : **5** : 477–78. [Bulgarian].

Haskovo 14 was selected from forms which arose by conversion of a land variety belonging to a Bulgarian group of tobaccos known as "Porojsko Seme" [Turbulent Seed]. Varieties of this type are characterized by polymorphism, in particular variability in plant height and length of leaf. The variation observed in the plants which arose by conversion however exceeded the normal limits of variability of Porojsko Seme and the plants resembled none of the known tobacco varieties or forms, from which they differed in their pyramidal habit, exceptional vigour and absence of reproductive organs. Three of these plants were induced to flower and ripen seed. The progeny were 1·80 m. tall and bore 60–65 large leaves. They

developed small round inflorescences with pale pink flowers. The plants showed resistance to drought, diseases and thrips.

2981 Wittmer, G.
Richerche genetiche su caratteri quantitativi in *Nicotiana*. Nota III—Influenza di trattamenti con raggi X applicati al seme sulla variabilità di alcuni caratteri fiorali. (**Genetic researches on quantitative characters in *Nicotiana*. III. Influence of treatment with X rays applied to the seed on the variability of some floral characters**).
Tabacco, Roma 1959 : **63** : 385–97.
Seeds of five lines belonging to the cultivars Virginia Bright, Maryland and Burley were irradiated with 9048 r. and 18096 r.; a dose of 36192 r. proved almost completely lethal. The plants produced by some of the lines after treatment with 18096 r. contained several individuals with abnormal floral development, there being a significant interaction between doses and lines and significant differences between plants in almost all lines; Virginia Bright line T19 was the most sensitive and showed variation in all the floral characters studied, which involved the radius of the corolla in various parts, base of the longest corolla lobe, length of corolla lobes and height of corolla. No significant variations resulted from the treatment with 9048 r.

2982 Berbeć, J.
Hodowla mieszańcowych odmian tytoniu (*Nicotiana tabacum* L.). Cz.I. Krzyżówka Virginia Joyner x Perustica puławska 3800. – Cz.II. Krzyżówka Kentucky 3002 x Szamoszaty. [**Breeding hybrid varieties of tobacco (*N. tabacum* L.). I. The cross Virginia Joyner x Perustica puławska 3800. II. The cross Kentucky 3002 x Szamoszaty**].
Hodowla Roślin Aklimatyz. Nasiennictwo 1959 : **3** : 31–67.
The four hybrids from the first cross are Złotolistny [Goldleaf] 109, 110, 113 and 248. Złotolistny 109 is vigorous, slightly later than the other three and similar to the Perustica type in quality and Złotolistny 110 is also vigorous, its leaves becoming bright when cured; it grows rapidly and is highly resistant to *Thielaviopsis basicola*. Złotolistny 113, also resistant to *Th. basicola*, shows more of the American characteristics, is shorter in growth and produces fewer leaves; it is susceptible to low or fluctuating temperatures. The last variety is very vigorous, early and highly resistant to *Th. basicola*. All except the last are suited to flue curing.
The two varieties Kentucky 118 and Kentucky 119, both from the second cross, are earlier than Kentucky 3002 and resist *Th. basicola*. The first yields more high-quality tobacco than the second.

2983 Krisnamurty, K. V. & Appa Rao, K.
A note on the ovule development in carpelloid stamens of a *Nicotiana* hybrid.
Curr. Sci. 1960 : **29** : 23–24.
Among the plants developed from the cross (*N. glutinosa* x *N. trigonophylla*) x *N. megalosiphon*, one individual exhibited modified stamens bearing ovules. From the similar occurrence of this phenomenon in *N. megalosiphon* x *N. glauca* hybrids it is suggested that some factor in the *N. megalosiphon* genome may be involved.

2984 Alcaraz Mira, E.
Estudios genéticos sobre la combustibilidad del tabaco. (**Genetical studies on the combustibility of tobacco**).
An. Inst. nac. Invest. agron., Madr. 1959 : **8** : 203–669.
In continuation of work reported earlier [XXVI, 570], detailed results of selection for combustibility in varieties and hybrid progenies during 1953–58 are presented. Sumatra continued to give relatively high values throughout the period but could not be improved by selection. Lines from cross 246 (hybrid 20 x Valencia) were among the best up to 1954 and after this were surpassed by some of their hybrids with other plants. Cross 274 (246 x hybrid 243) was best from 1955 to 1957 but was excelled in 1958 by 216, 317 and 318, all of them hybrids with 274 in their parentage.

2985 Wells, P. V.
Variation in section Trigonophyllae of Nicotiana.
Madroño, S. Francisco 1960 : **15** : 148–51.
Typical *N. trigonophylla* and *N. palmeri* are connected by a continuous series of intergrading forms; it is recommended that the latter taxon be reduced to a subspecies or variety of the former.

2986 Renaud, R.
L'oïdium du tabac. (**Powdery mildew of tobacco**).
Rev. int. Tabacs 1959 : **34** : 151–60.
The confused nomenclature and multiplicity of

races of this parasite are discussed together with disease symptoms and methods of control. An account is given of plant improvement work in various countries.

2987 Psareva, E. N. & Matveenko, T. M.
(The resistance to black root rot of some introduced tobacco varieties).
Tabak (Tobacco) 1960 : No. 1 : 21–23. [Russian].
The Bulgarian varieties Džebel Sekirka [Sekirka Mountain] and Rila 9, American and Hercegovina originating from Jugoslavia and Molovata from Rumania were the only introductions from the collection of the USSR Institute of Tobacco whose resistance to *Thielaviopsis* has been confirmed by artificial infection trials at Krasnodar.

2988 **A tobacco first.**
Agric. Res., Wash. 1960 : 8 :No. 8 : p. 15.
PD611 is being released to breeders of fluecured and other tobaccos for use as a nematode-resistant parent. It is not being introduced as a commercial variety because its cured leaves are below top quality and unacceptable to some manufacturers; it also has the defect of susceptibility to black shank and bacterial and *Fusarium* wilts. It is satisfactory as regards nicotine and sugar contents, flavour and aroma.

2989 Watanabe, A. & Harada, S.
(The effect of treatment of slips of tea varieties on the rooting and growth of the cuttings).
Chagyo Gijutsu Kenkyu/Stud. Tea 1959 : No. 21 : 1–7; and Chagyo Kenkyu Hokoku/Tea Res. J. 1959 : No. 14 : 1–7. [Japanese].
This description of various techniques for promoting rooting of tea cuttings includes data on varietal differences in rooting capacity.

2990 Sakamoto, Y.
(Studies on the composition of tea flowers. IV. On substances inhibiting pollen-tube growth in tea and the content of tannins in the various parts of the tea flower).
Chagyo Kenkyu Hokoku/Tea. Res. J. 1959 : No. 13 : 97–103. [Japanese].
Some figures are given for fruit set in crosses involving varieties differing in the size and disposition of the floral organs. It was found that pollen-tube growth *in vitro* was inhibited by more than 0·1% l-epigallocatechin or l-epicatechin. Tables are presented showing the tannin content of the pistil, ovary, stamens, petals and leaves of a series of Japanese varieties. The tannin contents of the pistils and leaves were not correlated.

2991 Takahashi, T. & Yanase, Y.
(Studies on flower-bud differentiation in the tea plant. II. The effect of plucking on flower-bud differentiation).
Chagyo Gijutsu Kenkyu/Stud. Tea 1959 : No. 20 : 1–5; and Chagyo Kenkyu Hokoku/Tea Res. J. 1959 : No. 13 : 12–16. [Japanese].
Information is included on the number and situation of the flower buds in eight Japanese varieties.

2992 Ueno, K., Saito, H., Iwahori, G. & Fukatsu, S.
(A survey of the characteristics of the black tea of various varieties).
Chagyo Gijutsu Kenkyu/Stud. Tea 1958 : No. 19 : 32–48. [Japanese].
A detailed comparative account is given of the style and colour of the tea and colour, flavour and aroma of the liquor of the variety Benihomare and four C strains.

2993 Ueno, K., Sugiyama, H., Saito, H. & Iwahori, G.
(Studies on the process of manufacturing sencha tea from different varieties. I. Investigation of the properties of different varieties for preparing sencha tea).
Chagyo Gijutsu Kenkyu/Stud. Tea 1959 : No. 21 : 19–29; and Chagyo Kenkyu Hokoku/Tea Res. J. 1959 : No. 14 : 24–34. [Japanese].
Data are provided on leaf size and colour, quality of the green tea (sencha grade), total and soluble nitrogen, and behaviour during manufacture, of samples of 11 varieties from the first, second and third pluckings. The quality of most of the varieties depended little on time of plucking but Yabukita, Asutsuya, S6 and U9 gave a superior product from the first plucking. Correlations were obtained between total and soluble nitrogen content and quality. Differences were noted between varieties in the ways in which quality was affected by variations in processing.

2994 HARADA, S., NAKAYAMA, A. & MITSUI, M.
(Studies on the winter hardiness of tea. I. On injuries to tea leaves associated with strong freezing winds and soil-moisture conditions and varietal differences in this respect. II. The effect of temperature and day length on the growth of tea varieties and differences, in this connexion, in winter hardiness).
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1959 : **28** : 105–08 [Japanese].

In the first paper, a comparative study of seven varieties showed that the leaves of varieties most damaged by refrigerating winds lost more water than the leaves of varieties less seriously affected. In the second paper it is shown that early varieties are more prompt in commencing growth in response to increase in temperature than late varieties but are also more damaged by subsequent exposure to — 5° C. for 1 hr.

2995 FUCHINOUE, H., TOMO, N. & FUCHINOUE, Y.
(The relation between the winter hardiness of the tea plant and the negative colloids as determined by the colloid-titration method).
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1959 : **28** : 111–12. [Japanese].

A comparative investigation of nine varieties showed that cold resistance is positively correlated with content of negative colloid. The chemical nature of the colloid is not yet known.

2996 FERNÁNDEZ, C. E.
Información sobre los trabajos en las instituciones de investigación. **(Report on work at the research stations).**
Café, Turrialba 1959 : **1** : 55–58.

Work on coffee at Chocolá, Guatemala, includes the introduction of varieties, the maintenance of lines resistant to rust, the production of intervarietal crosses and the study of the effects of radiation upon seeds.

2997 PAGACZ, E. A.
Quelques considérations sur la floraison du caféier. **(Some considerations on flowering in coffee plants).**
Bull. agric. Congo belge 1959 : **50** : 1531–38.

The production of normal flowers in coffee plants was found to be associated with a short period of drought followed by heavy rain; during the drought period the flower buds undergo a kind of dormancy. By the application of a 100 p.p.m. solution of gibberellic acid at a certain critical stage in flower bud development, it has been possible under greenhouse conditions to induce simultaneous flowering in Robusta and Arabica clones.

2998 CARVALHO, A.
Comportamento de progênies de café. **(Behaviour of coffee progenies).**
Bol. Suptda. Serv. Café, S. Paulo 1959 : **34** : No. 387 : 9–10.

Brief reference is made to differences in the reaction of progenies of var. *typica* and Bourbon Vermelho [Red Bourbon] to the addition of fertilizer, both in the sun and under shade.

2999 Nuevos progresos en la selección de tipos de café resistentes a la herrumbre (Hemileia). **[Recent progress in the selection of coffee types resistant to rust (*Hemileia*)].**
Café, Turrialba 1959 : **1** : 63–64.

In this report of a paper by B. d'Oliveira, read at the Ninth International Botanical Congress in Montreal in 1959, an account of Portuguese work on *H. vastatrix* and *H. coffeicola* is presented. Among more than 200 samples of *H. vastatrix*, ten races and a number of biotypes were distinguished. Plants of different *Coffea* species vary in reaction from resistance to all ten races to complete susceptibility. Resistance to one race appears to depend upon a single dominant factor. One seedling from Ethiopia proved homozygous for resistance to all races against which it was tested, with the exception of one Philippine race. Intraspecific and interspecific crossing for resistance to known races has begun. No physiological specialization was detected in *H. coffeicola* and no *C. arabica* plants proved resistant. To obtain resistant material this species is being crossed with *C. racemosa*.

3000 SYLVAIN, P. G.
Some observations on *Coffea arabica* L. in Ethiopia.
Turrialba 1955 : **5** : 37–53.

After a brief review of the ecology and taxonomy of wild coffees and coffees which have reverted to the wild in Ethiopia, notes on the following types occurring in the varietal collection now under study are provided: Ennarea or Ennaria; Jimma, Kaffa, and Anfilo, which appear to belong to one variety; Agarro or Agaro; Ciocce; Irgalem (Dalle); Dilla; Tafari-Kela; Arba Gougon Red Tipped; Harrar or Harar; Zeghie; Loulo; Wolkitte or Uolchitte; and Wollamo.

Of these, the Jimma-Kaffa group appears to be the most primitive, being characterized by a foliaceous semipersistent calyx. On the basis of leaf measurements, this group is closer to *Coffea arabica* var. *bourbon* than to *C. arabica* var. *typica*, which may indicate that *typica* is derived from *bourbon* rather than *vice versa* as generally believed. Some evidence of resistance to races of *Hemileia vastatrix* in Ethiopian varieties has been obtained, notably in the Wollamo and Jimma types. Other diseases and pests are rare.

3001 Liabeuf, J.
Les recherches cacaoyères à la Trinidad. (**Cacao research in Trinidad**).
Café, Cacao, Thé 1959 : **3** : 127–33.

A short account is given of the work of the Imperial College of Tropical Agriculture and the Cocoa Board of Trinidad in the development of clones resistant to *Marasmius perniciosus* from hybrid populations bred from local Trinitario types and the Amazon types of Forastero.

3002 Griffiths, L. A.
A comparative study of the seed polyphenols of the genus *Theobroma*.
Biochem. J. 1960 : **74** : 362–65.

A report is given of the result of an analysis of polyphenols in seeds of *Theobroma* and *Herrania* spp. at the Imperial College of Tropical Agriculture, Trinidad. The major polyphenolic constituents of *Th. cacao* were found to be present in a wide range of species in both genera. The polyphenols in *Theobroma* are sufficiently characteristic to permit identification of species by paper-chromatographic examination of the seeds. No marked variations in phenolic compounds other than anthocyanins were noted among clonal varieties of *Th. cacao*. Anthocyanins were absent from all *Theobroma* spp. other than *Th. cacao*. The possibility of an association between the presence of anthocyanins and the chocolate-flavour principle is however ruled out by the fact that Criollo, although unpigmented, is widely used in chocolate manufacture.

3003 **Administration Report of the Agriculture Department of Trinidad and Tobago for the year 1957** (1959) : Pp. 49.

The following cacao breeding items are among the activities briefly reported:—
Hybridization between high-yielding parents and witches' broom resistant clones and selection of progenies combining these characters continued. It is stated that "a significant development during the period under review has been the discovery of hybrid cocoa seed, which places at the disposal of the cocoa industry a new source of improved planting material."

3004 Blauwmaanzaad, 1960. (**Poppy, 1960**).
Landbouwvoorlichting 1960 : **17** : Bijl. 64; Ber. Rassenkeuze : No. 281 : unpaginated.

In tests of Emmabloem [Emma Flower], Nobel and S.v.P.4 in the Netherlands, the last, a new variety, gave good yields and produced seeds of high quality.

3005 Hrishi, N. J.
Cytogenetical studies on *Papaver somniferum* L. and *Papaver setigerum* DC. and their hybrid.
Genetica 1960 : **31** : 1–130.

Cytogenetical studies on a sample of *P. setigerum* ($2n = 44$) obtained from Malta and on five ecotypes of *P. somniferum* collected from Luik (Belgium), Bern (Switzerland) and Sacavém, Sintra-Algueiras and Lisbon (Portugal) are described; $2n = 22$ in the first four of these and 20 in the case of the Lisbon sample. The latter is regarded as a double monosomic and not as a nullisomic. Hybrid and F_2 populations are described.
To an unusual type of interlocking of bivalents during prophase to form chains which may be ring-with-ring or ring-with-rod associations and which separate out again as bivalents during late diacinesis, it is proposed to give the names pseudoquadrivalents, pseudosexivalents, pseudo-octovalents etc. On the assumption that these associations are controlled by five factors, the genotypes of the parents and progenies are formulated.
The mode of inheritance of height, branching, length and width of the leaf and the colour of petals, filaments and seed coat is discussed. The colours of filaments and petals are expressed independently, but the colour at the base of the petal and seedcoat colour were found to be correlated. An investigation of male sterility in the F_2 of the interspecific cross showed some correlation between flower colour and fertility.
Three genomes are indicated in *P. setigerum*: genome A consisting of 11 chromosomes which pair with those of *P. somniferum*; genome B consisting of 3 chromosomes which pair by autosyndesis; and genome C having 8 chromosomes which behave as unpaired chromosomes in the interspecific cross. *P. setigerum* is regarded as an allotetraploid of *P. somniferum* and the possible origins of genomes B and C are speculated upon.

3006 Kawatani, T. & Asahina, H.
External characters and alkaloids of the artificial interspecific F_1 hybrid between *Papaver orientale* L. (♀) and *P. somniferum* L. (♂).
Idengaku Zasshi/Jap. J. Genet. 1959 : **34** : 353–62.

One mature hybrid ($2n = 32$) was obtained from *P. orientale* ($n = 21$) ♀ x *P. somniferum* ($n = 11$) ♂. The adult leaves were hispid on both surfaces and the petioles canaliculate, as in the ♀ parent. The mode and extent of resemblance to the parents in leaf characters varied, however, according to the stage of growth. For some months after germination, the hybrid was very similar to the ♀ parent but from early April, it began to resemble the ♂ parent more closely. Finally, by late May, it was intermediate between the parents. The stems, peduncles, flower buds and floral organs resembled those of *P. orientale*. Mode of branching of the flowering shoot was however similar to that in *P. somniferum*. The presence of codeine and morphine in the hybrid is ascribed to *P. somniferum*. The ♀ parent conferred the character of isothebaine content. Either or both of the parents could have been responsible for the occurrence of thebaine. Oripavine, found in the ♀ parent, was not detected in the hybrid.

MINOR CROP PLANTS

3007 Mors, W. B., Magalhães, M. T. & Gottlieb, O. R.
Physiological varieties of *Ocotea pretiosa*.
Perfum. essent. Oil Rec. 1959 : **50** : No. 1 : 26–27.

Two physiological varieties of *O. pretiosa* have been distinguished in Brazil. One contains methyleugenol as the main constituent of its essential oil and no safrole, while the other, used as a source of sassafras oil, has safrole as its major oil component and no methyleugenol. The two compounds are closely related.

3008 Yoshida, T.
(Physiological and ecological studies on the process of essential-oil secretion in the oil geranium. VI. Differences in properties between species and varieties).
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1959 : **28** : 121–23. [Japanese].

Essential-oil production and composition were studied in Japanese material of *Pelargonium denticulatum* and introductions of *P. roseum* from France, Italy and the USA. The oil content of *P. roseum* is considerably below that of *P. denticulatum*. As regards the composition of the oil the two species differ, and, within *P. denticulatum*, the American sample differs from the French and Italian samples. *P. roseum* is superior to *P. denticulatum* in oil quality.

3009 Pichenot, M.
Sur la nature et le devenir des modifications obtenues chez *Capsicum annuum* L. var. *cayennense* à la suite de greffage sur *Datura stramonium* L. **(On the nature and development of the modifications obtained in *C. annuum* L. var. *cayennense* after grafting on *D. stramonium* L.).**
CR Acad. Sci., Paris 1960 : **250** : 214–16.

Among 19 successful grafts of *C. annuum* var. *cayennense* on to *D. stramonium*, seven yielded normal fruits which gave normal progeny while the remainder bore extra-large fruits with a greater number of seeds of which up to 30% were malformed and inviable. The 400 seedlings obtained from the abnormal fruits were all more vigorous, had darker green foliage, flowered later and more abundantly and bore larger fruits with many more seeds, all of which were viable, than seedlings from the normal-fruited grafts, from grafts on *Capsicum* or from ungrafted plants. The modifications were inherited, with slight variations in vigour and fruit size, through six generations. Grafts of normal on to modified plants gave a number of fruits with the same type of abnormality, but in this case it was not heritable. In reciprocal crosses between normal and modified plants, the abnormality was maternally inherited. It is concluded that a cytoplasmic modification is involved.

3010 Pichenot, M.
Résultats obtenus par le greffage de *Capsicum annuum* L. var. *cayennense* sur *Datura stramonium* L. **(Results obtained by grafting *C. annuum* var. *cayennense* on *D. stramonium* L.).**
Bull. Soc. Sci. Bretagne : Sci. Math. Phys. Nat. 1957 (1958) : **32** : p. 19. (Abst.).

Certain scions produced very large fruits with modified flavour. Seed collected after self pollination gave rise to vigorous plants with fruits much larger than those of the grafted

parent. Cells with $2n = 26$, 28, 30 and 34, were noted in addition to the normal $2n = 24$.

3011 Campos, F. F.
Haploid parthenogenesis in *Capsicum frutescens* L. following crosses with untreated and X-rayed pollen.
Diss. Abstr. 1959 : **20** : LC Card Mic 59–1893 : 40–41. (Abst.).

Two autodiploid lines derived from colchicine treatment of haploids were used as ♀ parents in crosses by means of untreated and X-irradiated pollen of Floral Gem. One line, G168A, was characterized by an unusually high frequency of twins composed of a maternal haploid and a sexual diploid. The other line, P1A, produced few multiple seedlings and no haploid members. Floral Gem, with a low frequency of multiple seedlings, differed from the autodiploids in heritable fruit characters, identification of the resulting multiple seedlings and haploids as to origin thus being possible. X irradiation of the pollen of Floral Gem did not significantly alter the type and frequency of multiple seedlings produced by C168A or P1A. Seventeen monoembryonic haploids were found in the X_1 from G168A x Floral Gem, obtained by means of pollen exposed to 1000 or 2000 r. All but one of the haploids bore fruits, on the basis of the characters of which it was possible to classify the plants as maternal in origin. Only one haploid, paternal in origin, was detected in the F_1 of P1A x Floral Gem; no haploids were found in the X_1. The genotype of the ♀ parent in this species is therefore of primary importance in regard to haploid parthenogenesis in both polyembryony and monoembryony.

3012 Cook, A. A. & Anderson, C. W.
Inheritance of resistance to potato virus Y derived from two strains of *Capsicum annuum*.
Phytopathology 1960 : **50** : 73–75.

The resistant peppers P11 and SC46252 were crossed with the susceptible varieties California Wonder, Florida Giant, Improved Worldbeater and Yolo Wonder, and back crosses were effected in the F_1 populations. The reaction to inoculation with PVY–N and PVY–C strains was recorded in the parents, in three subsequent generations and in the F_1 back-cross populations. Resistance was found to be determined by a single recessive gene designated y^a. The resistant varieties were homozygous for the recessive allele and the susceptible varieties were homozygous for the dominant allele Y^a.

3013 Schulz, K. & Troll, H.-J.
Beobachtungen über Winterfestigkeit und Spätsaatverträglichkeit von Winterraps, Winterrübsen und ihren Bastarden.
(Observations on the winter hardiness and the adaptability to late sowing of winter swede rapes and winter turnip rapes and their hybrids).
Z. Acker- u. PflBau. 1959 : **109** : 430–41.

The varieties and strains tested were sown at various dates between 20 August and 20 September for three years and observations were made on overwintering capacity. The results were however not satisfactory for determining winter hardiness, differences between varieties and strains being rather low. At Müncheberg turnip rape was found to be less winter hardy than swede rape. Marked variations in yield in different years indicated the need to improve winter hardiness.

3014 Culp, T. W.
Inheritance of plant height and capsule length in sesame, *Sesamum indicum* L.
Agron. J. 1960 : **52** : 101–03.

Study of four crosses indicated that height was controlled by 3–10 pairs of genes, with heritability values of 40–50%. In three crosses, tall plants were completely dominant while in the fourth no dominance of genes for either short or tall stature was detected. In the same four crosses, capsule length depended on 2–5 pairs of genes, heritability values ranging from 50 to 70%. In one cross long capsules were completely dominant, whereas in the other three such capsules were partially dominant. Progeny intermediate in height may be the result of the balanced effect of dominant genes for tall plants and dominant genes for short stature, while a combination of dominant genes for long capsules and others dominant for short capsules could account for partial dominance of long capsules. The small but significant positive correlation found between height and capsule length in three crosses is not expected to lead to difficulties in selecting for desirable combinations of the two characters.

3015 Nakamura, H. & Sato, T.
[Studies on sesame. III. On F_1 plants obtained from *Sesamum radiatum* ($n = 32$) x *S. angolense* ($n = 16$)].
Hyogo Noko Daigaku Kenkyu Hokoku : Nogaku Hen/Sci. Rep. Hyogo Univ. Agric. : Ser. Agric. 1958 : **3** : 146–52. [Japanese].

Two hybrids were obtained, each intermediate

morphologically between the parents and exhibiting hybrid vigour. In one hybrid, $2n = 48$, the modal meiotic configuration being $17^*_{II} + 14_I$; in the other, $2n = 64$, the modal meiotic configuration being $12_{III} + 4_{II} + 20_I$. It is inferred that the latter hybrid resulted from fertilization by an unreduced gamete of *S. angolense*, that $x = 8$, and that the two species have two genomes in common. [Cf. XXIX, 4283].

3016 NAKAMURA, H. & SATO, T.
[Studies on sesame. IV. On F_1 plants obtained from *S. angolense* ($n = 16$) x *S. latifolium* ($n = 16$)].
Hyogo Noko Daigaku Kenkyu Hokoku : Nogaku Hen/Sci. Rep. Hyogo Univ. Agric. : Ser. Agric. 1958 : **3** : 153–57. [Japanese].

The sterile hybrid resulting from this cross is intermediate morphologically between the parents and displays hybrid vigour. The modal meiotic configuration is $2_{II} + 28_I$, indicating lack of genomic affinity.

3017 MALAGUTI, G. & MAZZANI, B.
Casos de esterilidad en ajonjolí. **(Cases of sterility in sesame).**
Agron. trop., Venezuela 1958 : **8** : 63–65.

An abnormality in which the capsules are few, rounded, more or less reduced in size and restricted to the upper part of the plant has been observed in the variety Venezuela 52. Vegetative instead of flowering shoots often develop in the axils, and flowers, when formed, may fail to set fruit. The condition is attributed partly to genetic and partly to climatic factors.

3018 CULP, T. W.
Inheritance and association of oil and protein content and seed coat type in sesame, *Sesamum indicum* L.
Genetics 1959 : **44** : 897–909.

Rough testa, the dominant character of a single gene pair controlling testa type, is associated with low germ percentage and low oil content. Germ percentage, the complement of the seed remaining after decortication, was measured in the parents, in three filial generations and in back crosses to each parent. Oil and protein content of the whole seed was measured and calculated on the basis of germ percentage on the assumption that all the oil and protein was carried in the germ.

The apparent partial dominance of low oil content is attributed to the low germ percentage resulting from the greater contribution of rough testa to total seed weight. When the effect of rough testa was eliminated there were indications of partial dominance of high oil content. Some evidence was also found for partial dominance of high protein content.

An average of the heritability values obtained using four different methods of estimation gave values of about 70, 60 and 50% for germ percentage, protein and oil content respectively. A study of the factors controlling each character indicated that the number of conditioning genes in each case was low. From the combination of large heritability values and low gene numbers it is concluded that selection for the characters considered should proceed rapidly.

3019 STONE, W. J.
Sesame blight caused by *Helminthosporium sesami.*
Phytopathology 1959 : **49** : 815–17.

No resistant plants were found among 267 lines tested for disease reaction in Texas. Fourteen lines however showed some degree of tolerance.

3020 POTTER, G. F.
The domestic tung industry. I. Production and improvement of the tung tree.
Econ. Bot. 1959 : **13** : 328–42.

Mention is made of five varieties officially released by the United States Department of Agriculture in 1957. Three of these, Gahl, Isabel and La Crosse, have already been reported [cf. XX, 2550].

Folsom is a low-heading variety of high productivity. The fruits are large, mature late, turn purplish as they reach maturity and contain about 21% oil. Lampton is a low-heading variety which is said to have outyielded all others. It bears large, early-maturing fruits having an oil content of 22%.

Attempts to induce the blossoming habit of *Aleurites montana* in *A. fordii* by hybridization and back crossing to *A. fordii* are in progress.

3021 MERRILL, S. (JUN.), NEFF, M. S. & LAGASSE, F. S.
Resistance in tung clones and seedling progenies to *Mycosphaerella aleuritidis.*
Proc. Amer. Soc. hort. Sci. 1959 : **74** : 232–35.

Resistance to *M. aleuritidis* is now a major objective in the tung-breeding programme of the US Department of Agriculture. Seedling progenies of certain varieties, such as Lamont,

* 16_{II}, presumably an error, in Table 2.

F–554, G–37 and M–67, have shown much more resistance than any of the seedling progenies at present recommended for commercial planting. Other characteristics of the resistant seedling progenies are however unsatisfactory from the commercial point of view. These progenies may prove useful as parents in crosses with acceptable types. Seedlings of Lamont are rather variable and growers are reluctant to plant budded trees; by inbreeding it may be possible to secure a variety consisting of uniform seedlings.

3022 Georgieva-Todorova, Y.
(Interspecific vegetative hybridization in the genus *Helianthus*).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1958 : **5** : 195–209. [Bulgarian].

The variety 3–18 of *H. annuus*, which is not resistant to *Orobanche cumana*, was grafted on to *H. rigidus* and *H. lactiflorus*, both of which are resistant. The grafts *H. annuus*/*H. rigidus* showed various modifications in form and colour and usually ripened 10 to 15 days later than normal 3–18. The seeds of the grafts were not uniform in size and colour and the fat content was lower than that of seeds from normal 3–18. The F_1 plants of these grafts also showed morphological variation and some had an improved oil content in the seeds. Most of these plants were resistant to *O. cumana*; this resistance and vigour of the F_1 were transmitted to the next generation. F_1 plants of *H. annuus*/*lactiflorus* were early ripening, and resistant to *O. cumana*; they had short stems and a higher oil content in the seed than the variety 3–18.

3023 Ashri, A. & Knowles, P. F.
Cytogenetics of safflower (*Carthamus* L.) species and their hybrids.
Agron. J. 1960 : **52** : 11–17.

Nine species of *Carthamus* are grouped in four sections on the basis of chromosome numbers, morphology and ease of hybridization. Section I ($2n = 24$) includes *C. oxyantha*, *C. palaestinus* and *C. tinctorius*; section II ($2n = 20$) includes *C. alexandrinus*, *C. glaucus*, *C. syriacus* and *C. tenuis*; in section III ($2n = 44$) is a single species, *C. lanatus*; and in section IV ($2n = 64$) is *C. baeticus*. *C. arborescens* and *C. caeruleus*, both with $2n = 24$, were not assigned to sections because of their inability to hybridize with other species and their distinct morphology.

The species of section I are closely related to one another and distantly related to those of section II. The species of section II were not studied sufficiently to establish relationships between them, but they appear to be more closely related to *C. lanatus* than to any species of section I. *C. baeticus* is an allohexaploid having a 12-chromosome genome and two nonhomologous 10-chromosome genomes. *C. lanatus* appears to be one of its progenitors and either *C. leucocaulus* or *C. nitidus* is suggested for the other on morphological grounds.

3024 Thomas, C. A., Rubis, D. D. & Black, D. S.
Development of safflower varieties resistant to *Phytophthora* root rot.
Phytopathology 1960 : **50** : p. 129.

A combination of greenhouse and field tests was employed in developing varieties resistant to *Phytophthora* root rot by crossing Nebraska 10 with Western Oilseeds 14 (resistant) and back crossing, with Nebraska 10 as recurrent parent. A line obtained by selfing plants selected after the BC_1 was released in 1958 as Gila [cf. XXIX, 2991]. Another resistant line, B7–398–1, a selection after the BC_6, has also shown promise. Nearly identical agronomically with Nebraska 10, it equalled or surpassed this parent in yield in preliminary tests during 1958.

3025 Bouharmont, P.
La culture d'embryons *d'Elaeis guineensis* Jacq. **(The culture of embryos of *Elaeis guineensis* Jacq).**
Agricultura, Louvain 1959 : **7** : 297–323.

The culture of embryos on synthetic media as a means of hastening germination was investigated. While cultivated forms generally responded less well than wild forms it was possible by the techniques described to obtain satisfactory germination of the *pisifera* type.

3026 **Report for 1958-1959 (twelfth year) of the Wattle Research Institute, University of Natal, Pietermaritzburg.** 1959 : Pp. 51.

A study is being made of F_2s and back crosses involving black wattle (*Acacia mollissima*) and green wattle (*A. decurrens*) to discover whether seedlings differ in their behaviour according to the species from which they derived their cytoplasm. If the dominant character of shorter time of seed ripening shown by green wattle could be transferred to black wattle, considerable advantage would be gained in breeding. From families of second back crosses of green x black wattle to black wattle, it has not however been possible to determine with any certainty the segregation for shorter and longer periods of ripening. A few putative F_2 hybrids of black wattle x *A. baileyana* possess sufficiently good form and vigour to merit further study.

With increasing age, differences between S_1 families [presumably of green wattle] and the uniformity within families are becoming increasingly obvious. These differences indicate that morphological characters such as "straight or wavy stem, number and angle of branches, and forking and dimpling of the stem below each lateral branch" are largely under genetic control. Marked differences occur between the selfed families in incidence and type of gummosis, suggesting scope for selection for resistance. Of the progeny trials, one planted in 1955 was analysed in some detail for branching characteristics. The families differed significantly in height of forking, angle of lateral branches, quantity of lateral branches and type of laterals, suggesting that branching habit is to a considerable extent genetically determined. Significant differences were also found between families in incidence of gummosis and black butt. The correlation between parent trees and progenies (open-pollinated) with respect to degree of gummosis was significant.
Preliminary tests on *A. mollissima* and *A. irrorata* suggested that exclusion of large insects by means of an aluminium-wire cage covered with nylon gauze formed a fairly effective barrier to cross pollination and therefore that wind-borne pollen may be an important factor in cross pollination.

3027 Ćorović, M. & Čanak, M.
Promene na biljnoj vrsti *Hyssopus officinalis* L. kao posledice zračenja semena x-zracima. (**A change in the plant species *H. officinalis* L. as the result of irradiating seeds with X rays**).
Arh. poljopr. Nauk. 1958 : **11** : 55–60.

Seeds were irradiated with doses of X rays varying between 100 and 35,000 r. and then sown in garden soil. Germination was good but most of the plants from seeds which had received the higher doses died without completing their development. Plants from treated seeds showed changes in stem branching and in the number and distribution of flower buds, these changes being most pronounced at the higher levels of treatment. Some alterations in number and structure of stomata and in the structure of leaf tissues were also observed. Plants from treated seeds were considerably heavier than the control plants from untreated seed. The irradiation caused a decrease in the essential-oil content in early stages of development but in the fruit-bearing stage an increase was found in plants which had received X-ray doses of up to 15,000 r. The heaviest plants had the lowest oil content and it is pointed out that attention must be paid to improving oil content as well as plant weight. The results show that the higher doses of irradiation do not always have the greatest effect.

3028 Tétényi, P.
Zur Frage der chemischen Taxa der *Digitalis lanata* Ehrh. (**On the question of chemical taxa in *D. lanata* Ehrh**).
Pharmazie 1959 : **14** : 690–91.

Ligeti's paper [XXIX, 4294] is criticized on the ground that: (*a*) the forms rich in desired glycosides showed inbreeding depression resulting in increased disease susceptibility after two generations and on further inbreeding failed to set fruit; and (*b*) the glycoside-rich types, since they are not stable, cannot be termed chemical varieties. The question of the taxonomic status of stable chemical variants is discussed.

3029 Pantulu, J. V.
Studies in the Caesalpiniaceae. III. Cytological observations in *Cassia* species.
Proc. Indian Acad. Sci. : Sect. B 1960 : **51** : 19–31.

Using Indian specimens, the following species were found to have $n = 14$: *C. glauca*, *C. occidentalis*, *C. sophora* (= *C. purpurea* and *C. torosa*), *C. auriculata*, *C. marginata*, *C. obtusifolia*, *C. fistula* and *C. alata*. *C. glauca* var. *suffruticosa* had $n = 28$. Observations on secondary association suggested $x = 7$ as a basic number. Jacob [cf. X, 966] has reported $n = 7$ for *C. auriculata* from Ceylon and Senn [cf. X, 565] $n = 6$ for American material of *C. alata*. No relationship between chromosome number and growth habit was detectable. The author is in agreement with Senn's suggestion that species at present assigned to *Cassia* should be placed in one of two genera, *Cassia* and *Chamaecrista*, the first including species representing a polyploid series with $x = 6$ and 7 and the second members of a polyploid series with $x = 8$.

3030 Burkill, H. M.
Large scale variety trials of *Hevea brasiliensis* Muell-Arg. on Malayan estates 1934-53.
J. Rubb. Res. Inst. Malaya 1959 : **16** : 1–37.

Details are given on the performance of (1) "old clones", comprising several Malayan clones, such as Prang Besar 186 and Glenshiel, together with three Javan clones, (2) seedling families and (3) the RRIM 500 series and other newer

clones tested under RRIM numbers. The characters which have been recorded are girth, incidence of brown bast, virgin bark thickness and rate of first renewal, and yield from virgin bark. Of all the material tested, only RRIM501 has proved to be so outstanding for its consistently high yields and in other respects as to merit special recommendation for planting either inland or on the coast.

3031 **RRIM 600 series clones.**
RRI Plant. Bull. 1960 : No. 46 : 8–13.
The results of a further year's tapping in the large-scale trials of clones RRIM 500–618 and RRIM 619–30 at the Rubber Research Institute of Malaya are reported [cf. XXIX, 4296].

3032 Evers, E.
La présélection des semenceaux en hévéaculture. (**Preselection of seedlings in rubber growing**).
Sér. tech. INÉAC 1959 : No. 58 : Pp. 62.
For early identification of potentially superior seedlings, selection procedures based firstly on vigour and subsequently on yield potential are described. Yield potential is determined on two-year-old trees by the Testatex technique and confirmed at 3½–4 years by the Hamaker - Morris-Mann test. The advantages of field selection over nursery selection are discussed. [Cf. XXIII, 2145].

3033 de Silva, C. A. & Chandrasekera, L. B.
A method of inducing floral stimulus for early flowering of *Hevea brasiliensis*.
Quart. J. Rubb. Res. Inst. Ceylon 1959 : **35** : 50–55.
A method of inducing early flowering in young budded plants is described which should prove valuable in breeding. The results obtained are possibly the outcome of the action of both "gravimorphism" and ring barking. Sufficient controls were not introduced to differentiate clearly between these two effects.

3034 **Annual Report of the Rubber Research Institute of Malaya 1957** : Pp. 95.
Nearly 1000 seedlings were obtained from hand pollinations representing 11 different crosses, in five of which the *Dothidella*-resistant clone FX25 figured as ♂. The results of the first year of tapping in the trial of seedlings from hand pollinations made in 1947 showed that family RRIM507 x Tjir 1 gave a promising yield, closely followed by Tjir 1 x RRIM501. The second year of tapping in the large-scale trial of clones RRIM600–618 at the experimental station of the institute was completed [cf. XXVIII, 4580]. Completion of the first year of tapping in the large-scale trial of clones RRIM619–30 is also reported [cf. XXVIII, 3313].

3035 Irvine, J. E. & Freyre, R. H.
Reversal of genetic dwarfism in *Tephrosia vogellii* by gibberellin.
Nature, Lond. 1960 : **185** : p. 115.
In conjunction with a project for breeding for higher rotenone content at the Federal Experiment Station, Mayagüez, Puerto Rico, "multiple crosses were made between two lines of similar morphology, but of separate geographical origin". Nine dwarf plants appearing in an F_2 of 103 individuals were characterized by greatly reduced internodes, hypocotyls, petioles and rachides. Normal growth of the dwarfs was entirely dependent on periodic applications of gibberellin.

3036 Tominaga, Y.
(**Cytogenetical studies on pyrethrum. I. A comparative examination of the morphology and pyrethrin content of polyploids of *Chrysanthemum cinerariaefolium***).
Idengaku Zasshi/Jap. J. Genet. 1959 : **34** : 381–85. [Japanese].
Diploid, triploid and tetraploid strains were compared. The relative ranking was as follows: (1) stem height, $3n>4n>2n$; (2) capitulum weight, $4n>3n>2n$; and (3) pyrethrin content, $2n = 3n>4n$.

FRUITS AND NUTS

Proceedings of the International Symposium on Origin, Cytogenetics and Breeding of Tropical Fruits.
Indian J. Hort. undated : **15** : 101–286.

3037 *Tanaka, T. The origin and dispersal of citrus fruits, having their centre of origin in India. (pp. 101–15).*
After expressing the view that citrus classification should be based on sufficient differentiation into species [cf. VII, 766], the author surveys the linguistic, historical, geographical and botanical evidence throwing light on the origin of citrus fruits in India and their dispersal. Applying his classification, he also takes this opportunity of summarizing his views on evolution within *Citrus* and of *Poncirus* and *Fortunella*.

3038 *Schroeder, C. A. The origin, spread, and improvement of the avocado, sapodilla and papaya.* (*pp. 116–28*).

Information on the origin, distribution and improvement of *Persea americana, Achras sapota* and *Carica papaya* is surveyed and discussed. The methods and results of avocado breeding in the USA are described. Recently F_1 progenies of interest have been obtained from interracial crossings. Interspecific hybridization has so far made only limited progress. In the case of the sapote, improvement has to date been restricted to seedling and clonal selection in the USA and Asia. Genetical work published on sex in the papaya is outlined and its practical significance indicated. Attention is drawn to the possible value of other species of *Carica* in breeding.

3039 *Mukherjee, S. K. The origin of mango.* (*pp. 129–34*).

Referring to his earlier papers, the author discusses the origin of *Mangifera* spp. [cf. XXIV, 607] and offers suggestions as to investigations which should be undertaken in the fundamental study of the genus and improvement of the mango.

3040 *Krishnamurthi, S. & Seshadri, V. S. Origin and evolution of cultivated bananas.* (*pp. 135–45*).

A review is provided of the literature on *Musa* dealing with the following: taxonomy and interspecific relationships; geographical distribution of species; the role of vegetative propagation, parthenocarpy, sterility and polyploidy in the evolution of present-day cultivated bananas; and the origin of horticultural varieties

3041 *Dutta, S. Origin and history of citrus fruits of Assam.* (*pp. 146–53*).

Citrus spp. and their wild and horticultural varieties in Assam are surveyed with emphasis on their origin and history [cf. XXVII, 4379]. Several species, such as *C. indica, C. latipes, C. macroptera, C. medica, C. aurantium* and *C. sinensis,* are probably indigenous while *C. reticulata, C. limon* and a number of others may have been introduced into Assam from the beginning of the eighth to the end of the thirteenth century at the time of the invasions of the Shans and at later times.

3042 *Richards, A. V. Citrus fruits of hybrid origin in Ceylon.* (*pp. 154–58*).

Information is given on the commercial value of citrus varieties of hybrid origin occurring in Ceylon. An appendix providing a key to species and botanical varieties in that country is included.

3043 *Naik, K. C., Bhujanga Rao, C. & Raman, V. S. Problems in crop improvement in mango.* (*pp. 159–67*).

The limited amount of mango breeding so far carried out in India is surveyed. In view of the heterosis in yield and precocity of bearing found in some intervarietal crosses, a programme of controlled hybridization is advocated.

3044 *Singh, L. B. & Singh, R. N. Variability in the mango and its significance to the production of new varieties.* (*pp. 168–72*).

The role played by natural intervarietal cross pollination, allopolyploidy and somatic mutation in mango variability is considered. The results of breeding in India and other countries are briefly assessed. Suggestions are made as to the scope existing for improvement by intervarietal and interspecific hybridization, selection of bud mutants and induction of mutations by irradiation.

3045 *Bhujanga Rao, C. & Rangacharlu, V. S. Breeding new mango varieties in South India.* (*pp. 173–83*).

The authors summarize the results of studies on floral biology and of intervarietal crossing, undertaken since 1940 at the Fruit Research Station, Kodur. Information is provided on the fruit characters of 32 hybrids now planted for trial and on the main features of their parents.

3046 *Schroeder, C. A. The history, objectives, and present status of citrus breeding in the United States.* (*pp. 184–91*).

Breeding of citrus fruits and rootstocks by interspecific and intergeneric crossing in the USA receives a comprehensive review.

3047 *Tanaka, T. Breeding problem in Japanese citriculture.* (*pp. 192–98*).

An historical account of the development of cultigens of the Unshu (= Satsuma) mandarin by selection of local clones and bud mutants is followed by a discussion of further commercial possibilities with reference to variants more recently discovered in Unshu and other citrus fruits, performance of introductions and results of hybridization. The fact that only short-season types are suitable in the Japanese climate has restricted the potentialities of hybridization and introduction.

3048 *Kirpal Singh, K. Fruit improvement work in the Punjab.* (*pp. 199–202*).

The aims of mango, grape and citrus breeding in the Punjab are outlined and progress made in the scheme initiated on these fruits in 1956 is summarized. Studies have been made of floral biology, and hybridization is receiving

attention. In grape breeding, varieties with higher sugar content and early maturity are being sought. Waltham Cross x Seedless showed promise in these respects in 1958.

3049 *Parsai, P. S. Improvement of fruits in Madhya Pradesh with special reference to citrus and mango.* (*pp. 203–09*).

The article includes mention of breeding envisaged in *C. reticulata, C. sinensis, C. aurantifolia* and mango.

3050 *Dodds, K. S. Problems and techniques in breeding new varieties of bananas.* (*pp. 210–14*).

Breeding is viewed against the background of work carried out on improving the banana in the British West Indies, by means of primary tetraploids derived from crosses between diploid ♂ parents and edible triploids. None of the West Indian seedlings has reached the export market, although some have been bred which in other circumstances might have done so; growers have adopted Lacatan as their export variety and cannot lightly undertake changes. Reasons are however given for regarding continued breeding as worth while.

3051 *Gopalan Nayar, T. Genetic variability and the scope for improvement of the banana in India.* (*pp. 215–19*).

On a short-term view, selection of bud mutants offers greater scope and involves fewer difficulties than hybridization as a means of improving bananas in India. Useful mutants which have arisen in some important varieties are noted. Although limited by the sterility of the Cavendish group, hybridization should however be undertaken as a long-term measure, particularly because of the possibility that a disease such as bunchy top might become serious in future. Cooperation between banana breeders in India, Australia and the British West Indies is advocated.

3052 *Randhawa, G. S. & Singh, J. P. Varietal diversity and improvement of grapes.* (*pp. 220–27*).

Particularly with the aim of improving grape production in northern India, work is proceeding along three lines at the Indian Agricultural Research Institute, New Delhi: (1) collection and evaluation of varieties from different parts of India and foreign countries, (2) hybridization and (3) colchicine induction of polyploids. Descriptive notes are given on 18 varieties evaluated during the past few years, and an appendix listing the 150 varieties so far collected is included. In breeding for seedlessness, promising varieties such as Bhokri, Black Prince and Black Muscat were crossed with Pusa Seedless in 1958. *Vitis rotundifolia* and *V. labrusca* are being used as sources of resistance to *Cercospora viticola* and chafer beetle in crosses with *V. vinifera.*

3053 *Venkataratnam, L. & Satyanarayanaswamy, G. Studies on genetic variability in* Annona squamosa, *L.* (*pp. 228–38*).

Morphological variation in vegetative, floral and fruit characters of types from central and southern India and in foreign introductions was studied at the Fruit Research Station, Sangareddy, Andhra Pradesh. The fruits were also subjected to chemical analysis. Fruit characters are considered to be the most useful for diagnostic purposes, various features of the areole being of primary significance. A key is given for pomological classification within this species. Most of the types are regarded as bud sports, only Red custard apple and Mammoth breeding true. The occurrence of wild seedlings in abundance, natural interspecific crossing and the tendency to produce bud sports offer considerable scope to the breeder.

3054 *Dodds, K. S. Cytogenetics and the breeding of fruit trees.* (*pp. 239–47*).

Against the background of a discussion mainly reviewing the significance of incompatibility, polyploidy and spontaneous and induced mutation in breeding temperate fruits, the cytogenetics of the mango, *Citrus,* banana and other tropical and subtropical fruits is briefly considered in relation to problems of improvement.

3055 *Dodds, K. S. Incompatibility systems in relation to fruit breeding.* (*pp. 248–55*).

Types of breeding systems found in temperate and tropical fruits are surveyed with reference to the applicability of various methods of breeding.

3056 *Swaminathan, M. S. Induction of mutations in fruit trees—problems and techniques.* (*pp. 256–61*).

The author deals mainly with two major problems which have arisen in the induction of viable mutants in fruit trees: (1) competitive disadvantage of the mutant cells in growth and (2) the lethality of even low doses of acute radiation (5000–10,000 r.). Techniques developed in Germany and Sweden by which these difficulties have been surmounted are discussed.

3057 *Singh, R. N. Induced polyploidy in relation to the breeding of new varieties of fruit trees with special reference to* Carica papaya *Linn.* (*pp. 262–66*).

Work done on the induction of polyploidy in

temperate and tropical fruit trees is reviewed. As reported by the author, papaya tetraploids are highly sterile [XXVI, 3749]. Tetraploids of a greater number of varieties should be induced to see whether any are higher in fertility. The following are mentioned as being particularly suitable for improvement by induction of polyploidy and subsequent breeding: *Annona squamosa, Grewia asiatica, Syzygium cuminii, Aegle marmelos, Zizyphus mauritiana, Psidium guajava* and *Eriobotrya japonica.*

3058 Šipov, N. I.
(Preliminary results of varietal testing of horticultural plants).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 10 : 35–37. [Russian].

Apple, sour cherry and plum varieties showing great winter hardiness in recent trials at Tula are listed. They include two high-yielding and hardy apples and three sour cherries, all of which have been in cultivation for some years. Mention is also made of two black-currant varieties with high yields and berries of good flavour.

3059 Krishnamurthi, S., Randhawa, G. S. & Singh, J. P.
Induction of mutations in fruit trees —a review.
Indian J. Hort. 1958 : **15** : 94–100.

Recent work on mutation induction in apple, pear, cherry, black currant and citrus fruits is reviewed.

3060 Breider, H.
Röntgeninduzierte Mutationen bei *Vitis, Malus* und *Cyclamen.* **(X-ray-induced mutations in *Vitis*, *Malus* and *Cyclamen*).**
Bayer. Landw. Jb. 1959 : **36** : 396–401.

During many years of mutation breeding, it was found that the longer a variety has been vegetatively propagated, the lower is the X-ray dose required to induce mutation; useful mutants are only obtained with small doses and for the vine, the best dose is about 1000 r. Special attention has been paid to the induction of minor mutations; these do not affect viability and are often of commercial value. From *V. vinifera* 'Sylvaner' the four following mutants were obtained: (*a*) an early-ripening form; (*b*) an early-ripening form which is also high yielding; (*c*) a type with small berries; and (*d*) a muscat form. A small-leaved form of the Ontario apple was obtained by treating the buds with an X-ray dose of 5000 r. It is pointed out that a detailed knowledge of the developmental processes of the plants concerned is necessary for early recognition of such minor mutations. A major mutation, *rotundiflora*, was induced in *C. persicum* by irradiation of young tubers with 7500 r.; this fertile mutation involved an alteration in the size of the flower and the number of floral parts and it is thought that a gene complex was affected by the treatment.

3061 Palocsay, R.
Quelques résultats obtenus par la greffe pour l'amélioration des plantes. **(Some results obtained by grafting for the improvement of plants).**
Bull. Soc. Sci. Bretagne : Sci. Math. Phys. Nat. 1957 (1958) : **32** : p. 27. (Abst.).

The results of vegetative and sexual hybridization experiments between tomato (*Lycopersicon*) and pimento (*Capsicum*), and of experiments on vegetative hybridization of peach with almond and apple with pear are referred to.

3062 Cociu, V.
Noi metode şi rezultate ale selecţiei pomilor în U.R.S.S. şi importanţa lor pentru R.P.R. **(New methods and results in fruit breeding in the USSR and their importance for the Rumanian People's Republic).**
An. Romîno-Soviet. : Ser. Agric.-Zooteh. 1959 : **13** : No. 1 : 59–69.

The methods and achievements of Mičurinist fruit breeders in the USSR are reviewed with a view to extending the use of Mičurinist techniques in Rumania.

3063 Nijazov, D. N.
(Horticulture and viticulture in Turkmenistan).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 12 : 31–33. [Russian].

The principal varieties of pome and stone fruits and vines grown in Turkmenia are listed. The vines include Terbaš and Kara Uzjum Ašhabadskij [Ašhabad Black grape] which are characterized by midseason maturity and a high sugar content; they make high-quality wines.

3064 Ryynänen, A.
Marjojen viljelystä Pohjois-Savon koeasemalla. **(Berry cultivation at the North Savo trial ground).**
Koetoiminta ja Käytäntö 1958 : **15** : p. 33.

Raspberry. The variety Preussen has continued to show itself as high yielding and of good flavour, with fairly good disease resistance. Asker has small fruit of good quality and good winter resistance, but suckers strongly.

Black currant. The new variety Lepaa I has proved to be higher yielding than the commonly cultivated Osmolan, larger berried and of higher vertical growth. It is also more resistant to attack by gall mites.
Gooseberry. The varieties recommended are large-berried and resistant to powdery mildew: Hinnonmäen keltainen [Hinnonmäen Yellow] and Hankkijan Herkku [Hankkija Dainty], a red-berried type.
Blueberry. Varieties Pemberton and Rancocas have shown themselves promising.
Strawberry. Experiments since 1953 have indicated that the Danish variety Ydun gives the highest yield under local conditions and has the best quality and vegetative vigour.

3065 Brooks, R. M. & Olmo, H. P.
Register of new fruit and nut varieties. List 14.
Proc. Amer. Soc. hort. Sci. 1959 : 74 : 758–85.
A further annotated list of varieties of fruits and nuts introduced by official and commercial agencies in North America is provided [cf. XXIX, 3015].

3066 McCrory, S. A.
Preliminary evaluation and description of domestic and introduced fruit plants.
Bull. N. Dak. agric. Exp. Sta. 1958 : No. 471 : Pp. 39.
Information is given on the crab apples, apples, pears, sand cherries (*Prunus besseyi*) and apricots in the collection at the South Dakota Experiment Station. Their possible value for breeding and other purposes is indicated. The collection comprises repropagations of material collected from Asia by N. E. Hansen, North American entries and seedlings produced by breeding at the station.

3067 Šoškić, A.
Prilog poznavanju osetljivosti stabala nekih vrsta voćaka prema izmrzavanju. (**The susceptibility to freezing of some fruit trees**).
Zaštita Bilja 1959 : No. 51 : 69–81.
In studies conducted on trees 20–26 years old in two orchards at Peć, Yugoslavia, in the autumn of 1957 and the spring of 1958, plums suffered the greatest amount of frost damage to the trunk, followed by cherry, apple and pear, in that order. Požegača, the most severely damaged plum, was less badly affected when grafted on myrobalan; the most resistant plum was Car Dušan. Jonathan was the most susceptible apple.

3068 Lazaris, S. A.
(**A meeting of the V. I. Lenin All-Union Academy of Agricultural Sciences at Mičurinsk**).
Vinodelie Vinogradarstvo SSSR (Winemak. & Vitic. USSR) 1959 : No. 8 : 55–57. [Russian].
The utilization of distant hybridization and other breeding methods for improvement of winter hardiness, yield and quality of fruit trees and vines were the subjects discussed at a conference held in Mičurinsk in August 1959.

3069 Moruju, G. & Sluşanschi, H.
Studiul corelaţiei dintre procesele de creştere şi de fructificare la pornirea în vegetaţie a cîtorva soiuri de măr şi păr. (**The study of the correlation between the processes of growth and fruiting at the commencement of shooting in some apple and pear varieties**).
Lucrăr. şti. Inst. Cercet. hort.-vit. Băneasa-Bucureşti 1957 (1959) : 317–30.
Apple and pear varieties can be divided into two categories: (1) those in which flowering precedes vegetative-shoot development and (2) the converse situation. The former include the higher yielding varieties. Information is included on the content of dry matter, N, P and K at various stages in development of representative varieties of these two categories.

3070 Moruju, G.
Rezultatele lucrărilor de ameliorare a sortimentului de măr şi păr la Staţiunea experimentala pomicolă Voineşti. (**The results of work on the improvement of the apple and pear varieties at the Voineşti Pomological Experimental Station**).
Lucrăr. şti. Inst. Cercet. hort.-vit. Băneasa-Bucureşti 1957 (1959) : 331–43.
Numerous hybrids have been reared in an attempt to breed the above species for resistance to fungous diseases. Of the apples used as parents, Reinette Ananas, Belle de Boskoop, *Malus kaido* and *M. zumi* conferred resistance to *Venturia inaequalis*; resistance to *Podosphaeria leucotricha* was greatest in hybrids between Golden Pearmain and wild species and in Wealthy x Reinette Baumann. In the pears, Josephine de Malines, Pietroase de Cluj and Williams conferred resistance to *V. pyrina* and

Duchesse d'Angoulême and Pietroase de Cluj resistance to *Septoria pyrina.*

3071 Boerema, G. H. & Gremmen, J.
Een oppervlakkige bastkanker bij appel en peer veroorzaakt door *Pezicula corticola.* (**A superficial bark canker in apple and pear caused by *P. corticola*).**
Tijdschr. PlZiekt. 1959 : **65** : 165–76.

The symptoms of the above disease are described and the taxonomy and nomenclature of the pathogen reviewed. Among apple varieties, Jonathan was attacked while Cox's Orange Pippin and Golden Delicious remained unaffected. The pear varieties Bonne Louise d'Avranches and Conference were badly infected, Beurré Clairgeau and Doyenné du Comice less badly and Beurré Hardy very much less.

3072 Okolitenko, V. A.
(The best apple varieties for the woody-steppe region of the Ukraine).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 10 : 37–38. [Russian].

Kal'vil' Mleevskij [Mleev Calville], Wealthy and Jonathan gave high yields in trials at Skvira, Kiev province. All three are resistant to frost and scab and produce high-quality fruit with good keeping properties. Kal'vil' Mleevskij is resistant to drought.

3073 Dubrovskaja, L. I.
(Apples in the Burjat ASSR).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 10 : 38–42. [Russian].

Some winter-hardy varieties from a collection of 109 different sorts tested for hardiness at Ulan-Udè are listed. They include a few large-fruited varieties such as Grušovka Moskovskaja [Moscow pear], Borovinka and Papirovka, which overwinter well provided they are protected against frost by mats covered with a layer of earth.

3074 Dayton, D. F.
Red color distribution in apple skin.
Proc. Amer. Soc. hort. Sci. 1959 : **74** : 72–81.

The cellular distribution of anthocyanin pigment in the fruit skin proved to be a distinct varietal characteristic in most cases. The epidermal layer in McIntosh, Cortland, Spartan, Jonathan, Jonared, Red Spy, Starkrimson and Wellspur contains a high proportion (60–95%) of pigmented cells. Delicious, Starking and Richared have an almost colourless epidermis. Stripes and chimera-like sectors of deeper red colour in Delicious and Starking are the result of a great number of cells with anthocyanin in the hypodermal layers. The light-red sectors commonly found in Starking are apparently the result of slow or delayed development of pigmentation but may be sectorial chimeras or may possibly arise by layer replacement. The results are discussed in relation to the mode of origin of colour sports.

3075 Brown, D. S., Hesse, C. O. & Koch, E. C.
Reversion of red sports of Delicious apple.
Proc. Amer. Soc. hort. Sci. 1959 : **74** : 40–46.

Observations on red-fruited sports of Delicious in California and the Pacific Northwest have indicated that sports which are predominantly striped, such as Starking and Red King, are more prone to reversion than sports with a uniform colour, such as Richared and Royal Red.

3076 Gröber, K.
Mutationsversuche an Kulturpflanzen. XI. Die Erzeugung von somatischen Mutationen mittels Röntgenstrahlen beim Obst. (**Mutation experiments on cultivated plants. XI. The production of somatic mutations by means of X rays in fruit**).
Kulturpflanze, Berlin 1959 : **7** : 37–54.

The uppermost buds of apple twigs were irradiated and the twigs were then grafted on to other trees. Using this procedure the losses were considerably smaller than when whole twigs were irradiated; 80% of the twigs treated with 7500 r. continued to develop after grafting. The cambium seems to be more susceptible to radiation damage than the buds, which also have a greater capacity for regeneration. Various abnormalities of development occurred as a direct result of the treatment but these were not related to any genetic change. It was not possible to decide whether the variations in fruit observed were of a genetic nature except in respect of the change to red colour of Weisser Klarapfel [White Clear apple]; this character showed a mutation rate of 4·8%.

3077 Einset, J. & Pratt, C.
Spontaneous and induced apple sports with misshapen fruit.
Proc. Amer. Soc. hort. Sci. 1959 : **73** : 1–8.

Six spontaneous sports in Rhode Island Greening, McIntosh and Northern Spy and one sport of Cortland, presumed to have been induced by thermal-neutron treatment, are described. The

sports are alike in having fruits with irregular longitudinal furrowing but may be distinguished by differences in depth of furrows, size of the lobes and amount of russeting and cracking. The sports are probably periclinal chimeras.

3078 Botez, I.
Despre soiul de măr Ionathan. (**On the apple variety Jonathan**).
Grădina Via Livada 1958 : **7** : No. 5 : 43–47.

A description of this variety is followed by an account of the fruit set resulting from crosses between this variety, either as male or female parent, and numerous other varieties grown in Rumania.

3079 Botez, I.
Contribuţiuni la cunoaşterea comportării soiului de măr Ionathan în procesul de polenizare. (**Contributions to the knowledge of the behaviour of the apple variety Jonathan in the process of pollination**).
Lucrăr. şti. Inst. agron. Petru Groza Cluj 1958 : **14** : 191–203.

The optimum conditions for artificial germination of the pollen of this variety are a 9% sucrose solution at 23° C. Data are provided on the fruit set of numerous pollinations involving Jonathan as either male or female parent.

3080 Tudosescu, O.
Comportarea cîtorva soiuri locale de măr ca portaltoi în pepinieră pentru principalele soiuri de măr cultivate în regiunea I pomicolă. (**The behaviour of some local apple varieties as rootstocks in the nursery for the principal apple varieties cultivated in apple-growing region I**).
Lucrăr. şti. Inst. Cercet. hort.-vit. Băneasa-Bucureşti 1957 (1959) : 297–305.

Some seedlings of local Rumanian varieties have been found useful as rootstocks for several of the more important varieties grown in Rumania.

3081 Rootsi, N. & Fernqvist, I.
Schwankungen des Askorbinsäuregehaltes bei einzelnen Apfelsorten auf Grund von Analysen, durchgeführt 1952–1957 in Alnarp. (**Variations in ascorbic acid content in a number of apple varieties on the basis of analyses carried out at Alnarp in 1952-57**).
Acta agric. Scand. 1959 : **9** : 299–320.

Data on the ascorbic acid content of seven varieties analysed for two or five years in the period 1952–57 are presented, Cox's Pomona having the highest average value. The relation of ascorbic acid content to year, place of origin, fertilizer treatment, climate, fruit colour, total titratable acid and soluble dry matter is considered in detail.

3082 Säkö, J.
Omenien putoamisen vähentämisestä ennen sadonkorjuuta ja sen aikana. (**On the reduction of apple drop before and at the time of harvest**).
Maataloust. Aikakausk. 1959 : **31** : 81–89.

The effects of sprays on a number of apple varieties are recorded, in particular of 2,4,5-TP, which, in addition to controlling drop, improves the colour of some apples, notably Melba and Atlas.

3083 Eitel, J.
Wachstum und Reproduktivität bei einigen Apfelsorten. (**Growth and reproducing capacity in some apple varieties**).
Diss. Inst. Obstbau Gemüsebau Stuttgart-Hohenheim 1959 : Pp. 78. (Mimeographed).

A detailed study of the vegetative and reproductive development of four apple varieties is reported.

3084 Karavan, V. V.
(**Two apple crops in a year**).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 9 : p. 77.

Trees of an unidentified apple variety cropping twice a year were found at Plahteevka, Odessa province. The fruits are small but sweet. Second flowering normally sets in immediately after the first crop has been picked. A scion taken from one of the trees retained its unusual cropping habit after being grafted on a crab stock. This type is thought to be valuable for breeding apples with the double cropping habit.

3085 Aubertin, M. P.
The growth and development of embryo and endosperm in relation to seed abortion in certain tetraploid apples.
Diss. Abstr. 1959 : **20** : LC Card Mic 59–1999 : 15–16. (Abst.).

The normal embryogeny of Wrixparent and Giant Yellow Transparent, which are both $2x$–$4x$–$4x$ periclinal chimeras of $2x$ Yellow Transparent, did not differ markedly from that reported for other varieties. Pollen from $2x$ Jonathan effected fertilization about a day before pollen from $4x$ Jonathan. Mature embryos were found 69 days after pollination by the $2x$ or $4x$ parent. Several factors probably

contributing to the high rate or seed abortion in Wrixparent and Giant Yellow Transparent were however detected. Egg breakdown occurred as early as 18 hr. after pollination as the result of poor vigour of the flowers, and as late as 9 days after pollination through lack of fertilization. Wrixparent and 4*x* Jonathan may be incompatible, as suggested by the occurrence of swollen and crooked pollen tubes in this mating. Embryo degeneration accompanied by arrested endosperm development was found in Wrixparent 11 days after pollination. The observation that abortive seeds could be found in 4*x* apples all during the growing season is interpreted as indicating that abortion in such fruits continued over a rather long period. Seed germination was higher in crosses involving a 2*x* than a 4*x* parent.

3086 Nikitina, K. V.
(The keeping capacity of apples).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 9 : 56–59. [Russian].

Anatomical studies of apple varieties differing in maturation and keeping quality at Leningrad showed that the thickness of the skin did not necessarily indicate the keeping capacity of a variety for some varieties distinguished by good keeping properties had a thick skin while others had a thin skin, and among the thick-skinned varieties were several poor keepers. As a part of the same investigation, varietal differences in producing antibiotics capable of suppressing moulds and bacteria were studied. It was found that the substances produced by Rosemary, Champagne Reinette and other late varieties with good keeping properties had a stronger bactericidal effect and suppressed moulds more effectively than those produced by Šafran Krasnyj [Red Saffron] and other varieties of poor keeping quality.

3087 Säkö, J.
Omenien varastoimisesta. Varastoimiskokeet puutarhantutkimuslaitoksella piikkiössä vuosina 1954–58. **(On the storage of apples. Storage experiments at the department of horticulture in 1954-58).**
Valt. Maatalousk. Julk. 1959 : No. 173 : Pp. 22.

A number of apple varieties have been stored under controlled conditions of temperature and humidity. The best keeper is the Canadian variety Lobo which is palatable in November and keeps well into the new year. It is also more resistant to *Gloeosporium* rot. Varieties Atlas and Wealthy are also good keepers.

3088 Ure, C. R.
Breeding hardy apples for prairie Canada.
Agric. Inst. Rev. 1960 : **15** : 20–22, 54–55.

Early and current breeding is surveyed.

3089 Schander, H.
Die Frühselektion bei der Apfelzüchtung am Beispiel der Züchtungsarbeiten an der Obstbauversuchsanstalt Jork. **(Early selection in apple breeding as exemplified by the breeding work at the Fruit Cultivation Experimental Institute, Jork).**
Erwerbsobstbau 1959 : **1** : 174–76.

At Jork the possibilities of early selection have been investigated in seedlings from different crosses. Attention has been paid to those characters involved in adaptation to the environment. It was found that resistance to damage of the terminal buds by autumn frost, resistance to sun scald of the bark during frosty winter weather and resistance to flower damage by spring frosts are inherited independently and early selection for the three types of resistance is possible. The time when growth ceases in autumn and the time of leaf fall are important in adaptation to the environment and these characters have been found to vary between seedlings. Progenies from varieties recently introduced into this region had a high proportion of seedlings which ceased to grow during dry periods and these frequently occur in May. This unfavourable character was rare in progenies of the varieties Gelber Richard [Yellow Richard] and Glockenapfel [Bell apple], which have been long established at Jork.

Mention is made of the work of other breeders showing that early selection for resistance to *Venturia inaequalis* and *Podosphaera leucotricha* is successful; a positive correlation has been found between attack by *P. leucotricha* and dormancy imposed by dry conditions. Thus selection for resistance to mildew and drought may be combined. There is also some evidence that selection for resistance to *Nectria galligena* may be carried out on young seedlings but further investigation is required.

Loewel has selected hybrid seedlings on the basis of their resemblance (in growth habit) to the best of the parent varieties; most of the seedlings have not yet fruited but some have already given good results. Assessing the habit is however a subjective procedure.

Certain correlations between characters have been found useful for early selection. Large leaf is associated with heavy fruit, the wider

the leaf relative to the length, the flatter is the fruit, and the shorter the petiole relative to the leaf length, the heavier is the fruit. Early selection for other characters is also discussed.

3090 Bart, G. J.
Susceptibility of various apple varieties to the oak wilt fungus.
Phytopathology 1960 : **50** : 177–78.
Of the ten varieties tested for reaction to inoculation with *Ceratocystis fagacearum*, Cortland and Grimes Golden exhibited a high degree of resistance.

3091 Străulea, M.
Observații asupra unor hibrizi de păr intrați pe rod la Stațiunea experimentală Horti-Viticolă Cluj. (**Observations on some pear hybrids that have come into bearing at the Cluj Horticultural and Viticultural Experimental Station**).
Lucrăr. ști. Inst. Cercet. hort.-vit. Băneasa-București 1957 (1959) : 345–48.
Short descriptions are given of the following hybrids which may eventually prove to be of value under Rumanian conditions: 129–2, 127–2 and 222–1 (Beurré d'Hardenpont x Dr. Lucius), 251–1 (Clapp's Favourite x Président Drouard) and 69–1 (Beurré Clairgeau x Zaharoasă [Sugary]).

3092 Donno, G.
Su dieci cultivar di pero diffuse nel Salento. (**On ten pear cultivars commonly grown in the Salento area**).
Ann. Fac. Sci. agrar. Univ. Napoli, Portici : Ser. 3 1958–1959 : **24** : 307–15.
Descriptions are given of ten of the most common cultivars of the Salento area of southern Italy, with details of their origin, which however is mostly unknown, and their morphological features, fruit characters, time of ripening and quality. The earliest is Campanello, which matures in late June, and the latest is Taulone, ripening in August.

Annual report of the Agricultural and Horticultural Research Station, Long Ashton, Bristol, 1958 : Pp. 188.

3093 *North-Smith, G. A survey of perry pears in the west Midlands: II. South-west Gloucestershire.* (*pp. 67–69*).
Information is given on the names, synonymy and distribution of varieties in south-west Gloucestershire, England [cf. XXV, 1337].

3094 *Williams, R. R. & North-Smith, G. Perry pears and their characters: III.* (*pp. 70–77*).
A further 13 varieties of perry pears are described [cf. XXV, 1338 and XXVI, 1655].

3095 Liacu, A., Mitu, M., Cireașă, V., Roșu, F. & Duman, A.
Contribuții la studiul comportării cîtorva soiuri autohtone de păr în școala de pomi. (**Contributions to the study of the behaviour of some indigenous varieties of pear in the nursery**).
Lucrăr. ști. Inst. agron. Ion Ionescu de la Brad Iași 1959 : 309–13.
Preliminary data are given on the growth of 38 local Moldavian pears on quince rootstocks.

3096 Overcash, J. P. & Loomis, N. H.
Prolonged dormancy of pear varieties following mild winters in Mississippi.
Proc. Amer. Soc. hort. Sci. 1959 : **73** : 91–98.
The occurrence of wide differences among varieties in chilling requirements is reported.

3097 Böhm, H.
Zur Lebensweise und Bekämpfung von *Carpocapsa dannehli* Obr. (Marlinger Birnwurm) in Österreich. (**The biology and control of *C. dannehli* Obr. in Austria**).
PflSchBer. 1960 : **23** : 173–87.
Pear varieties were found to differ in their susceptibility to this pest. Pastorenbirne and Esperens Bergamotte were not attacked.

3098 Kegler, H.
Untersuchungen über Virosen des Kernobstes. II. Das Ringfleckenmosaikvirus der Birne. (**Investigations on viruses of pome fruit. II. Ring-spot mosaic virus of pears**).
Phytopath. Z. 1960 : **37** : 379–400.
Only varieties of great or medium susceptibility showed clearly distinguishable symptoms of ring-spot mosaic and only during May and June. Varieties of low susceptibility frequently showed diffuse spotting. Boscs Flaschenbirne [Bosc's Calabash], Bunte Juli, Clapp's Favourite, Grosse Rommelter [Large Rommelt], Gute von Ezée [Ezée's Good], Williams Bon Chrétien and *Pyrus salicifolia* were of low susceptibility. No symptoms were found on Alexander Lucas, Espérine, Köstliche von Charneu (= Fondante de Charneu), *P. aromatica*, *P. phaeocarpa* and others. Gellerts Butterbirne [Gellert's Beurré] and Neue Poiteau [New Poiteau] were the most susceptible.

3099 Dragavcev, A. P.
(***Crataegus*, a promising fruit crop**).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 12 : 47–48. [Russian].
Selection of *Crataegus pontica* in the central Asiatic republics and Transcaucasia is advocated.

3100 Bergann, F.
Les variations spécifiques dans la greffe selon Lucien Daniel et l'existence d'inductions partenaires chez les crategomespili de Bronvaux. (**Specific variations in grafting according to Lucien Daniel and the existence of inductions by the graft components in the *Crataegomespili* of Bronvaux**).
Bull. Soc. Sci. Bretagne : Sci. Math. Phys. Nat. 1957 (1958) : **32** : 24–25.
The establishment of interactions between the component tissues in *Crataegomespilus* by Weiss and Haberlandt is thought to necessitate a reconsideration of the classical concept of periclinal chimeras, according to which the component tissues coexist without change. A new case of interaction between the components in the flowers and fruit of *Crataegomespilus* is reported.

3101 Burloi, N.
Observaţii asupra rezistenţei mugurilor de cais la ger. (**Observations on the resistance of apricot buds to frost**).
Grădina Via Livada 1958 : **7** : No. 1 : 34–38.
In observations on six varieties at the Nicolae Balcescu Institute, Bucureşti, the flower buds of Timpurie de Thyrnau [Early Thyrnau] and Luizet were least damaged by spring frosts.

3102 Veress, S. & Illyés, G.
Contribuţiuni la selecţia prunului Bistriţa. (**Contributions to the selection of the Bistriţa plum**).
Lucrăr. şti. Inst. agron. Petru Groza Cluj 1958 : **14** : 204–16.
The above variety is widely distributed in central, south-east and east Europe under diverse names and shows considerable variability. Élites have been selected at Ciumbrud, principally for yield, winter hardiness and disease resistance.

3103 Ven'jaminov, A. N. & Korneev, V. A.
(**New plum varieties**).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 10 : 45–50. [Russian].
Supplementary details of research on interspecific hybridization, which has been previously reported, are given [cf. XXIX, 4359]. They include descriptions of Eurasia 4, 5, 21 and 43, which were obtained by pollinating the plum hybrid La Crescente by the multiple hybrid 15/18 or from open pollinations of La Crescente by *Prunus domestica* varieties. La Crescente has 16 chromosomes, hybrid 15/18, 32 and *P. domestica* 48 chromosomes. The hybrids from open pollination had 48 or 32 chromosomes. All the Eurasia varieties are self sterile, but fertile if pollen of *P. domestica* is available to them. Eurasia 43 has poor quality fruit and is therefore useless except as breeding material. The other varieties produce fruits of a flavour equal to the best plum varieties grown in central Russia and are superior to these in resistance to cold.
Seven new plum varieties are reported from the Dubovskij Horticultural Branch Station, Stalingrad province. They were obtained by crossing local varieties with south-Russian cultivars and are characterized by high yield, early bearing, great winter hardiness and large fruit of pleasant flavour. Ijul'skaja [July] is the earliest among them and Oktjabr'skaja [October] the latest.

3104 Oldén, E. J.
Hybrider mellan europeiska och japanska plommon framställda vid Balsgård. (**Hybrids between European and Japanese plums produced at Balsgård**).
Sverig. pomol. Foren. Årsskr. 1959 : 67–77.
In reciprocal crossings of 13 varieties of *Prunus domestica* ($2n = 48$) with seven of *P. salicina* ($2n = 16$), the respective fertilities of the diploid and hexaploid mother plants were: 8·4% and 3·3% fruit set; 13% and 83% full seeds; and, among the full seeds, 6% and 45% germination. Such hexaploids as Bonne de Bry, Hackman, Jefferson and Ruth Gerstetter, which are self sterile, gave poor results in crosses but the self-fertile varieties Early Laxton, Reine Claude d'Oullins, Očakov and Ontario were useful as female parents. Twenty-eight of the hybrids had $2n = 32$, and three pentaploids, 15 hexaploids, one heptaploid and one octoploid were also obtained. Since all female parents were emasculated, the large number of hexaploids suggests that pseudogamy may have taken place in the hexaploid mother plants. The other chromosome numbers indicate that both unreduced pollen and unreduced egg cells can take part in hybridization. Descriptions are given of six of the hybrids, five of them tetraploid and one octoploid. Two of the described tetraploids, both from Ontario x Santa Rosa,

have borne purple-skinned fruits with the characteristic aroma of Japanese plums and weighing 25 and 35 g., respectively; about 30% of the pollen is morphologically good. The octoploid, from the same cross, produced 95% good pollen which was capable of fertilizing hexaploid varieties, giving a good fruit set.

3105 Johansson, E.
Ariel—en ny plommonsort från Alnarp. (**Ariel—a new plum variety from Alnarp**).
Sverig. pomol. Foren. Årsskr. 1959 : 87–90.

Developed from a cross between Autumn Compot and Althans Reine Claude [Althan's gage], Ariel grows vigorously, produces highly fertile pollen, is self compatible and produces large oval fruits, which have red-yellow skin with a bluish bloom, and are juicy, good in flavour and suitable both for dessert and for canning.

3106 Burmistrov, A. D.
(**The results of testing Mičurin plum varieties in the Latvian SSR**).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 10 : 42–45. [Russian].

Two Mičurin varieties, Renklod Kolhoznyj [Kolhoz gage], Renklod Ternovyj [Sloe gage] and Renklod Severnyj [Northern gage], which was bred by Enikeev, exceeded standard varieties in winter hardiness and cropping capacity. Great variability in yield was observed between different clones of both varieties and clonal selection is advocated.

3107 Paunović, S. A.
Prilog proučavanju ekotipova dženarike u Zapadnoj Srbiji. (**A contribution to the study of myrobalan ecotypes in West Serbia**).
Arh. poljopr. Nauk. 1958 : **11** : 117–29.

The results are reported of morphological and physiological analyses of six ecotypes in Jugoslavia. Most of the ecotypes were self compatible and resistant to frost. With the exception of seedlings of three ecotypes, F_1 progenies were rather variable in form.

3108 Cojocaru, S. I.
Soiuri de prune autohtone din ţara Haţegului. (**Indigenous plum varieties of the Haţeg region**).
Grădina Via Livada 1957 : **6** : No. 9 : 38–42.

Pomological descriptions are given of six local varieties.

3109 Ševčenko, A. M.
(**The breeding of stone fruits at the Mleev Research Station**).
Agrobiologija (Agrobiology) 1959 : No. 2 : 198–202. [Russian].

The breeding of high-yielding winter-hardy plum, sweet cherry and sour cherry varieties with high-quality fruit for the Ukrainian woody steppe is described and observations are made on training promising new forms on various mentor stocks for improvement of the above characters. Crossing west European cultivars with winter-hardy local varieties or hybrids and raising seedlings from stones of open-pollinated standard varieties have given the best results. Two new plum and five sweet cherry varieties which have reached an advanced trial stage are listed; some other new varieties are on the way. The sweet cherries are all seedlings from open pollination of White Napoleon, Bigarreau Dönnissen or Francis.

3110 Pop, I. V.
O viroză păgubitoare a sîmburoaselor din R.P.R. (**An injurious virus disease on stone fruits in the Rumanian People's Republic**).
Grădina Via Livada 1958 : **7** : No. 10 : 49–52.

The effects of plum pox on the plum, apricot and myrobalan are described. It is noted that the plum varieties d'Agen, Anna Späth, Bühler Frühzwetsche, Sugar, Montfort, Early Rivers, Belle de Louvain and Prunul roşu timpuriu englezesc [English Early Red plum] are resistant.

3111 **Better cherries for the Northwest.**
Agric. Res., Wash. 1960 : **8** : No. 8 : p. 11.

Information is given on promising selections which may be released in the northwest of the USA in the near future. Most attention has been given to the development of dark-fruited selections, Bing, Van, Black Tartarian and several other varieties having been used as parents. Two light-fruited selections are however considered to be of such value that they may renew interest in white-cherry production in the region.

3112 Mills, I. K. & Afanasiev, M. M.
Host ranges and latent carriers of Lambert mottle in *Prunus* species.
Plant Dis. Reptr. 1959 : **43** : p. 1098.

A large number of cherry varieties have been inoculated at Montana Agricultural Experiment Station with Lambert mottle virus, and then

indexed on Lambert. Only Shirofugen, Montmorency, *Prunus virginiana* and Italian prune failed to give a positive reaction.

3113 Bašmakov, È. A.
(Peaches in the Issyk-Kul' valley).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 11 : 43–44. [Russian].
Introduction trials of peach cultivars in the above district of Kirgizia are mentioned and information on the yields of some nine-year-old trees is provided.

3114 Grilli, M.
La "Luisa Berselli" e la "Desideria", due nuove cultivar di pesco. **(Luisa Berselli and Desideria, two new peach cultivars).**
Progr. agric., Bologna 1959 : **5** : 1038–43.
Luisa Berselli is described as resistant to winter injury and early, maturing a few days before Amsden, the fruits being however larger, freestone and resistant to transport.
Desideria is a late sport from Hale, having large freestone fruits which ripen between Sant' Anna and Hale; they have white flesh and are good for transport.

3115 Bailey, C. H. & Hough, L. F.
An hypothesis for the inheritance of season of ripening in progenies from certain early ripening peach varieties and selections.
Proc. Amer. Soc. hort. Sci. 1959 : **73** : 125–33.
A detailed exposition is given of an hypothesis already summarized [XXIX, 931].

3116 Oberle, G. D., Moore, R. C. & Hardigree, J. B.
Washington, a peach with outstanding frost-escaping ability.
Fruit Var. hort. Dig. 1959 : **14** : 26–28.
The freestone variety Washington was developed from a cross between seedling VPI–15 and Sunhigh, the former parent being notable for its ability to withstand frost damage to the buds, blossoms and young fruit. The variety was developed at the Virginia Agricultural Experiment Station, Blacksburg, where it ripens about 21 days before Elberta.

3117 Bruhlej, M. A.
(Improving the winter hardiness of peach seedlings).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 8 : 45–46. [Russian].
The hardiest seedlings raised from stones at Ternopol' were those that had been vernalized for 90 days and grown in 10 hr. days in August. Seedlings given the same vernalization treatment but grown in normal days were less hardy but superior to seedlings from nonvernalized stones or stones vernalized for 20 days.

3118 Taylor, J. W.
Recent developments in nectarines in California.
Fruit Var. hort. Dig. 1959 : **14** : 23–24.
Information is given on (1) time of ripening, firmness, fruit size and chilling requirements of established commercial varieties and (2) ripening dates of nectarines now being tested on a limited commercial scale. Notes are included on the origin of both categories of varieties.

3119 Tanaka, T.
(The Himalayan zone and the origin of citrus fruits).
Engei Gakkai Zasshi/J. hort. Ass. Japan 1959 : **28** : 71–75. [Japanese].
On account of their diversity of wild *Citrus* spp., the east Himalayan foot hills are regarded as the primary centre of origin of the genus. From sect. *Papeda*, represented by *C. ichangensis*, sects. *Limonellus*, the limes, and *Cephalocitrus*, the shaddocks, are believed to have differentiated. Sect. *Citrophorum*, including the sweet lime, citron and lemon, is derived from sect. *Limonellus*, and sect. *Aurantium*, the oranges, from sect. *Cephalocitrus*. Sect. *Acrumen*, including the mandarins, is believed to have arisen in the Himalayan region from some such form as *C. indica*. Historical evidence that the basic *Citrus* types of southern China were derived from India is mentioned. Secondary speciation elsewhere has resulted in such forms as the grapefruit in the West Indies and the Bergamot orange in the Mediterranean region.

3120 Parlevliet, J. E. & Cameron, J. W.
Evidence on the inheritance of nucellar embryony in citrus.
Proc. Amer. Soc. hort. Sci. 1959 : **74** : 252–60.
In investigations at the University of California Citrus Experiment Station, Riverside, the degree of polyembryony in F_1 hybrids from crosses involving monoembryonic and polyembryonic types and in the parents was determined on the basis of embryo counts. The monoembryonic parents were the tangor Temple, Wilking and Clementine mandarins, a hybrid grapefruit named Sukega and four varieties of pomelo. The polyembryonic varieties were the tangors King, Dweet and Mency, the tangerines Frua and Ponkan and mandarins Kara and Honey. Crosses between monoembryonic parents gave

rise only to monoembryonic progenies, while crosses of these parents with the polyembryonic types produced both polyembryonic and monoembryonic offspring, in ratios approaching 1 : 1 in several cases. Crosses between polyembryonic parents were not made. Attention is however drawn to the facts that (1) the polyembryonic parents Dweet, Honey, Kara, Mency and Frua are each known to be F_1 hybrids from polyembryonic ♂ and ♀ parents, and (2) Wilking, also a derivative of two polyembryonic parents, is monoembryonic. It is postulated that a major gene (*P*) is responsible for polyembryony, varieties characterized by this condition having *PP* or *Pp*. The degree of polyembryony appears however to be determined by modifier genes (*M*).

3121 Oberholzer, P. C. J. & Hofmeyr, J. D. J.
The nature and control of clonal senility in commercial varieties of citrus in South Africa.
Faculty of Agriculture, University of Pretoria 1955 : Pp. 46.

Virus diseases are thought to be largely responsible for the serious decline affecting many citrus varieties. Various methods of control are discussed and the work now under way in South Africa is outlined. This includes the importation of nucellar selections from California and developing nucellar selections from existing varieties in South Africa. A promising new clone, the Palmer nucellar Navel and other valuable material are mentioned. Controlled pollination using *Poncirus trifoliata* as pollen parent is not thought to be necessary, for little difficulty has been found in differentiating between gametic and nucellar seedlings on the basis of vigour and morphological characters. There appears to be quite a high frequency of bud variation in citrus varieties and this may offer opportunities for selecting improved types. It is suggested that the presence of viruses in the cells is under genotypic control by the host and symptom expression depends on the concentration of virus present. Certain trees afflicted with tristeza have been found to have some buds apparently free of infection and it is possible that these buds have some genetic variation affecting the reaction to the virus.

3122 Majsunadze, N. I.
(Intervarietal hybrids and nucellar seedlings of orange).
Agrobiologija (Agrobiology) 1959 : No. 2 : 188–92. [Russian].

An account of breeding oranges at Suhumi, together with descriptions of eight new varieties which have reached an advanced trial stage, is given. The new varieties are distinguished by high quality of the fruit and early maturity and are all nucellar seedlings, except 14178 which is a hybrid between Washington Navel and a Chinese blood orange. The difficulty of distinguishing intervarietal hybrids from nucellar seedlings has been overcome by choosing suitable parents for crossing. In particular Early Jaffa and Lučšij iz Suhumi [Best from Suhumi] transmit distinctive morphological characteristics to their progeny. In addition, a monoembryonic form of the blood orange Gruševidnyj [Pear-shaped] has been found. Employed as ♀ parent it has so far given hybrid progeny in all crosses.

3123 **New early maturing tangerine hybrids.**
Fruit Var. hort. Dig. 1959 : **14** : p. 22.

All developed by crossing the tangerine Clementine and tangelo Orlando, the hybrids Robinson, Osceloa and Lee have been introduced for trial planting by the US Department of Agriculture. They all ripen before the standard tangerine Dancy.

3124 Randhawa, G. S., Singh, J. P. & Seshadri, V. S.
A promising new bud mutant in Foster grapefruit (*Citrus paradisi* Macf.).
Indian J. Hort. 1958 : **15** : 59–60.

A seedless mutant of the variety Foster was observed at the Indian Agricultural Institute, New Delhi. The mutant, which has been named Pusa Foster Seedless, carries 4–7 seeds per fruit as compared with 44–67 seeds in Foster, and has a considerably higher juice content. In other characters the mutant resembles the parent. It is now being propagated for further trials.

3125 Jarrett, F. M.
Studies in *Artocarpus* and allied genera, IV. A revision of *Artocarpus* subgenus *Pseudojaca*.
J. Arnold Arbor. 1959 : **41** : 73–109; 1960 : **41** : 111–40.

Two further instalments provide a revision of the above subgenus [cf. 752].

3126 Schroeder, C. A.
The floral situation of the carob in California.
Proc. Amer. Soc. hort. Sci. 1959 : **74** : 248–51.

Clones of *Ceratonia siliqua* studied in California fall into five groups in respect to sex expression:

(1) pistillate, (2) pistillate with occasional perfect flowers or stamens, (3) perfect with staminate flowers in some clusters, (4) perfect and (5) staminate.

3127 GHEORGHIU, L.
Contribuţii la cunoaşterea şi cultura nucilor la Sibişel. (**Contributions to the knowledge and cultivation of the Sibişel walnuts**).
Grădina Via Livada 1957 : **5** : No. 10 : 31–35.

The walnuts around Sibişel Vechi are heterogeneous as regards the morphology of the nut and are of value for breeding on account of their thin, easily cracked shells.

3128 MATEESCU, N.
Studiul înfloritului şi legării fructelor la nuc (*Juglans regia* L.). [**A study of flowering and fruit setting in the walnut (*J. regia* L.)**].
Lucrăr. şti. Inst. Cercet. hort.-vit. Băneasa-Bucureşti 1957 (1959) : 357–64.

A study of floral biology in walnut samples from the Dîmboviţa basin is reported. Protogynous trees were more productive than androgynous.

3129 FISCHER, F.
Versuche an Klonenmaterial von *Castanea* sp. (**Experiments on clonal material of *Castanea* sp.**).
Mitt. schweiz. ZentAnst. forstl. Versuchsw. 1959 : **35** : 437–79.

Clones of *C. sativa* and *C. mollissima* were used in these experiments. A reliable method of infecting plants with *Endothia parasitica* was developed; this involved transplanting infected pieces of bark into incisions in the stems of the test material. It is however difficult to assess accurately the degree of infection. Measurements of the size of the lesions taken four months after infection may be used to compare susceptibility. The clones varied considerably in their resistance to *E. parasitica*; only one clone of *C. sativa* showed high resistance but an optimistic view is held of the possibilities of selecting for resistance. Considerable variation between clones was also found in morphological and phenological characters.

3130 EVREINOFF, V. A.
Le choix des variétés de noisetier à cultiver dans le sud-ouest. (**The choice of hazel varieties for cultivation in the south-west**).
Ann. Éc. nat. supér. agron. Toulouse 1958 : **6** : 71–78.

To ensure effective cross pollination in species where the development of male and female gametes is not synchronized, and varies not only within a variety but also on a single tree, it is recommended that several varieties should be grown together. Twelve varieties suitable for the south-west of France are described, of which nine are derived from *Corylus avellana*, two from *C. pontica* and one from *C. maxima*.

3131 KIRPAL SINGH, K. & SARIN, P. L.
Studies on the varietal differences in fruit quality in litchi (*Litchi chinensis* Sonn.).
Indian J. Hort. 1957 : **14** : 103–07.

Seven varieties are compared for percentage of pulp and juice, and for ascorbic acid and sugar content. The variety Panjore Common is recommended for commercial cultivation in the Punjab.

3132 GILLES, A. & DE VINCK, A.
Recherches radio-génétiques chez *Arachis hypogaea* L. Effets phénotypiques globaux des rayons X. (**Radiogenetic investigations on *A. hypogaea* L. Total phenotypic effects of X rays**).
Agricultura, Louvain 1959 : **7** : 533–41.

Soaked seeds or excised embryos irradiated at 1000–20,000 r. showed a decreasing survival rate with increasing dose, the seedlings becoming inviable above 15,000 r. Vegetative and floral anomalies in the seedlings were induced by all doses, 10,000–15,000 r. being the most effective.

3133 BRYSSINE, M. P.
L'arachide et les essais de sa culture au Maroc. (**The groundnut and its cultivation in Morocco**).
Bull. Soc. Agric. Maroc 1957 : No. 75 : 1–18.

Mention is made of yield trials involving 60 introduced varieties. Bombay, Cuba 15–237, Cuba 15–708, White Spanish and Espagnole ranked highest.

3134 NIQUEUX, M.
Choix de variétés d'arachides au Tchad. (**The choice of groundnut varieties at Chad**).
Agron. trop., Nogent 1959 : **14** : 490–502.

Rose du Camaroun [Camaroon Pink] is recommended as a good-quality, high-yielding variety suitable for the dry northern region. Under very dry conditions the variety Bambey 28–206 produces a large number of empty shells and a high proportion of shrivelled kernels; it is therefore recommended only for the southern region of this zone.

Six selections made from local varieties have

given higher yields than the widely grown Bambey 28–206 in the southern zone.

3135 Srinivasalu, N. & Loganathan, N. S.
Inheritance of the purple crescent on the standard petal of *Arachis hypogaea* Linn.
Curr. Sci. 1959 : **28** : p. 497.

The Australian white bunch variety AH6742 was crossed with a number of varieties showing well defined crescents, and an examination of the F_2 showed that two factors were involved in the inheritance of this character. Absence of purple crescent is associated with stems devoid of anthocyanin and with white seed colour.

3136 Cooper, W. E. & Gregory, W. C.
Radiation-induced leaf spot resistant mutants in the peanut (*Arachis hypogaea* L.).
Agron. J. 1960 : **52** : 1–4.

Mutants resistant to *Cercospora personata* (*Mycosphaerella berkeleyii*) and *C. arachidicola* (*M. arachidicola*) have been developed by selecting for defoliation resistance in the X_2 and X_3 of X-irradiated plants of a Virginia Bunch selection. Resistance was maintained over nine generations and yield and fertility are high.

3137 Ahamed Bavappa, K. V. & Narasimha Murthy, K.
Occurrence of chlorophyll deficiency in arecanut (*Areca catechu* Linn.).
Arecanut J. 1959 : **10** : 53–57.

Six chlorophyll-deficient forms in seedlings of *A. catechu* are described; these are: albino, yellow, green with white stripes, green with yellow and white stripes, and two forms, designated "zebra", with leaves of normal colour except for a single transverse band which may be white or yellow. The albino and yellow forms are lethal.

These recessives are normally maintained in a heterozygous condition by natural cross fertilization. Their mode of segregation is thought to indicate either that some degree of selfing occurs, or that plants of similar genetic constitution are growing in close proximity.

3138 **Annual Report of the Coconut Research Board of the Coconut Research Institute, Ceylon, for 1957** (1959) : Pp. 79.

The performance of seven-year-old F_1 progenies of various crosses is reported. The *typica* x *nana* hybrids appear to be the best, for the palms are vigorous, early flowering and high yielding. Although the *typica* x King coconut cross is also vigorous it is of little importance owing to the high incidence of premature nut fall and the copra tends to be thin. Progenies of King coconut x *nana* show periodicity in bearing and are less tolerant of drought than *typica*. Some *typica* x *typica* F_1 hybrids have given yields considerably lower than those of *typica* x *nana* hybrids of comparable age.

A new method of storing pollen has been developed. Small quantities of pollen are introduced into pieces of glass tubing about 6 in. long and with an external diameter of 3–4 mm.; the tubes are hermetically sealed after leaving them in a desiccator containing 43% sulphuric acid for 2 to 3 hr. The sealed samples are then stored at 3–6° C. After more than seven months' storage, the percentage germination has varied between 28 and 73% for samples of *typica* pollen.

3139 Mendiola, N. B.
The necessity of selecting *cadang-cadang* resistant varieties or strains of coconut or of creating *Cocos* hybrids.
Araneta J. Agric. 1959 : **6** : 24–32a.

Emphasis is placed on the immediate need for selecting strains of coconut resistant to cadang-cadang which is thought to be a virus disease; interspecific hybridization may also help in developing resistant varieties. An outline of a suggested breeding programme is included.

3140 Nath, N. & Randhawa, G. S.
Some interesting floral abnormalities in the pomegranate (*Punica granatum* L.).
Indian J. Hort. 1959 : **16** : 20–22.

The occurrence is reported of petaloid ovules, secondary flowers, variegated petals, flowers without petals, modified stamens, and abnormal stigmas and calyces in seven varieties of pomegranate.

3141 Dai, B. B. [Tai, P.-P.]
(A preliminary comparison of papaya varieties).
Nung-yeh Yen-chiu/Agric. Res., Taipei 1958 : **8** : No. 1 : 30–34. [Chinese].

A comparative study of Taiwan varieties is reported, data being provided on morphological characters, resistance to waterlogging, fruit size and quality and yield. The best variety was Solo Fengshan 1.

3142 Dai, B. B. [Tai, P.-P.]
(Experiments on the utilization of F_1 papaya hybrids).
Nung-yeh Yen-chiu/Agric. Res., Taipei 1958 : **8** : No. 1 : 17–29. [Chinese].

Manifestations of heterosis in F_1 hybrids between the varieties Solo, Philippine and the local

variety 5 were studied. The hybrids tended to have reduced seeds but enhanced vegetative vigour. Those in which Philippine was one of the parents showed an advance in flowering date. The hybrids were more resistant to waterlogging than their parents; fruit weight and Brix, however, were slightly reduced. The F_1 combination Philippine x Solo is especially recommended.

3143 Zerpa, D. M. de
Tetraploidía en *Carica papaya* y *Carica cauliflora*. (**Tetraploidy in *C. papaya* and *C. cauliflora***).
Agron. trop., Venezuela 1958 : **8** : 67–73.
Colchicine-induced tetraploids of *C. papaya* included male and female plants, one hermaphrodite and one of the form *forbesii*. The pollen grains were larger than in the diploid and showed 30% sterility. The female flowers produced fruits with abundant seed when open pollinated or cross pollinated by the male tetraploids and the *forbesii* form. The plants from these crosses have appreciably larger stomata than diploids and firmer leaves. Quadrivalents, trivalents, bivalents and univalents were observed at meiosis but there appeared to be no irregularities of distribution, 18 chromosomes being seen in telophase I and metaphase II cells. Recently formed tetrads were likewise normal, but older tetrads regularly showed four cells of normal size and one or more small ones.
In *C. cauliflora* three male plants were found among induced tetraploids. Their pollen grains were larger than those of diploids and also showed 30% sterility. At meiosis 18 chromosomes were seen at each pole, with some secondary associations. The tetrads were generally normal.

3144 Britton, D. M. & Hull, J. W.
A black raspberry - blackberry hybrid.
Proc. Amer. Soc. hort. Sci. 1959 : **73** : 156–57.
A single 4*x* hybrid obtained from *Rubus occidentalis* (4*x*) x Eldorado blackberry (8*x*) probably contains two chromosome sets from each of its parents. The fruits are similar in size to those of the black raspberry Cumberland, seedy and with a flavour described as bland. The hybrid is to be crossed with (1) 4*x* black raspberries with the aim of attaining greater virus tolerance than is now present in black raspberries and (2) western trailing blackberries with high chromosome number in an attempt to reach the 6*x* condition as in the loganberry.

3145 Hårdh, J. E.
Uusista vadelmalajikkeista. (**New raspberry varieties**).
Koetoiminta ja Käytäntö 1959 : **16** : 6, 8.
Selections from the F_3 and F_4 of crosses between raspberry and *Rubus arcticus* have been made with the aim of producing a raspberry-type fruit with improved winter and drought resistance and satisfactory flavour, acidity and form of growth.
The lines Y14 and Y30 are strong growing, good flavoured and tall, but only Y30 has satisfactory winter hardiness.
The variety Rikala is strongly recommended on account of its suitability for cultivation in southern Finland.

3146 Nybom, N.
Hallonodlingens virusproblem—sett ur växtförädlingssynpunkt. (**The virus problem in raspberry culture—from the point of view of plant breeding**).
Sverig. pomol. Foren. Årsskr. 1959 : 47–60.
The following Swedish work is reported. A beginning has been made at Balsgård with the development of inbred lines for the production of hybrid seed free from virus infection. Virus tolerance is known to occur in some varieties and hypersensitivity in *Rubus occidentalis*, but neither reaction is sufficiently well known yet to be used as a basis for breeding. Resistance to the vectors *Amphorophora rubi* and *Aphis idaei* is being studied in inoculation tests. So far, Malling Landmark, Chief and varieties of *R. occidentalis* and *R. occidentalis* x *R. idaeus* have shown good resistance to *A. rubi*; Antwerpiska Gula [Antwerp Yellow] and Malling Promise were moderately resistant. The *A. rubi* race involved appears to be the same as that prevalent in the rest of Europe and different from that occurring in America.

3147 Roelofsen, B.
Resultaten van de proefvelden blauwe bessen in 1959. (**Results from the blueberry trial fields in 1959**).
Fruitteelt 1960 : **50** : 343–44.
Results of yield trials of eight varieties at Sloten, Netherlands, in 1957–59 are included.

3148 Darrow, G. M.
Blueberry breeding. Past present future.
Amer. Hort. Mag. 1960 : **39** : 15–33.
A comprehensive review is given of the achievements and aims of blueberry breeding in the

USA. Detailed information is included on the species and selections available as possible sources of a wide range of desired characters.

3149 Scott, D. H., Moore, J. N., Knight, R. J. & Hough, L. F.
The Collins blueberry. A new variety.
Bull. NJ agric. Exp. Sta. 1960 : No. 792 : unpaginated.

Moore, J. N.
New blueberry is introduced.
NJ Agric. 1959 : **41** : No. 6 : 4–5.

In ripening time, Collins (Stanley x Weymouth) is between Earliblue and Blueray. The bushes are erect, vigorous and moderately productive. The fruits are large, light blue, firm and highly flavoured, the clusters being medium sized and rather tight. The fruit buds possess about the same degree of cold hardiness as those of Berkeley and Earliblue.

3150 Hårdh, J. E.
Pensasmustikan viljelyä haittaavista tekijöistä Suomessa. (**On the drawbacks of blueberry cultivation in Finland**).
Maataloust. Aikakausk. 1959 : **31** : 131–40.

The most successful variety is Rancocas, which gives the best yield and has greatest winter hardiness, and can be profitably grown in the southernmost parts of Finland. The most serious disease is canker caused by *Fusicoccum putrefaciens*, but symptoms have not been found on the varieties Rancocas and Rubel.

3151 Eršov, A. F.
(***Hippophae* in the Zavolž'e**).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 12 : 61–62. [Russian].

Introduction trials of *H. rhamnoides* raised from seed originating in Siberia, central Asia and the Caucasus are reported from Kinel'. The Siberian form was the most productive and produced berries with the most pleasant flavour and an aroma reminiscent of pineapple. Six plants have been selected for their sweet juicy berries.

3152 Eaton, E. L., Aalders, L. E. & Hall, I. V.
Hybrids of an interspecific cross of elder.
Proc. Amer. Soc. hort. Sci. 1959 : **73** 145–46.

Hybrids between *Sambucus canadensis* 'Victoria' and the early-maturing species *S. pubens* were produced at the Regional Research Station, Kentville, NS, in the hope of developing a commercially acceptable elder ripening its fruits early and thus escaping autumn frost. They bore fruit but their seeds were completely devoid of embryos. Their chromosome number was $2n = 36$, as in each parent. Meiotic irregularities were observed and no stainable pollen was formed. Induction of amphidiploids by treating the hybrids with colchicine is being attempted.

3153 Hårdh, J. E.
Suositeltavia mansikkalajikkeita. (**Recommended strawberry varieties**).
Koetoiminta ja Käytäntö 1959 : **16** : p. 18.

The varieties Ydun and Wädenswil III are most highly recommended, the yield being greatest in Ydun, but the latter having the better flavour. Senga Sengana also yields well but is more acid and has irregularly shaped berries.

3154 Dijksterhuis, H. P.
Opbrengst- en kwaliteitsverloop van aardbeirassen en de gebruiksduur van een aardbeienaanplant. (**Yield and quality performance of strawberry varieties and the serviceable lifetime of a strawberry bed**).
Tuinbouwber., Groningen 1960 : **15** : p. 6.

In trials of 15 varieties at Zeerijp, Netherlands, early strawberries gave a higher percentage of small fruits as the plants aged than midseason or late varieties. It is recommended that plants of Regina be retained for two years only and plants of Senga Sengana and Macherauchs Späternte [Macherauch's Late Harvest] for two or three years.

3155 Łucka, M.
Badania nad wartością produkcyjną dziesięciu odmian truskawek. (**Studies on the value of the product of ten strawberry varieties**).
Roczn. Nauk rol. 1959 : **80** : 23–38.

Data on yield, quality, chemical composition of the fruit, morphological characters of the plant, flower and fruit, and fertility are given for ten varieties tested in Poland in 1955–57.

3156 Scott, D. H.
Size, firmness, and time of ripening of fruit of seedlings of *Fragaria virginiana* Duch. crossed with cultivated strawberry varieties.
Proc. Amer. Soc. hort. Sci. 1959 : **74** : 388–93.

In a study of the above three fruit characters, the following progenies were grown in replicated

plots: F_1 *F. virginiana* x Midland, a sib cross of two F_1 selections (the equivalent of an F_2), back crosses of two F_1 selections to Midland and two outcrosses to unrelated cultivated varieties (Fairpeake and Fairland). Size, expressed as weight, was governed by a number of genes, small fruits being partially dominant. The back-cross and outcross progenies varied considerably in size and afforded much greater scope for selection for large fruit than the F_1 or sib seedlings. All seedlings in all progenies were relatively soft fruited. None approached the firmness of firm-fruited cultivated varieties, although the fruits of the back-cross seedlings were significantly firmer than those of the outcrosses. The fruit of a high proportion of the seedlings from all matings ripened early, with the exception of seedlings from the outcross to Fairpeake.

3157 Slate, G. L. & Watson, J.
Three new strawberries, Fletcher, Frontenac and Fulton.
Fm. Res. 1959 : **25** : No. 4 : p. 10.

Slate, G. L. & Watson, J.
Fletcher, Frontenac and Fulton strawberries.
Fruit Var. hort. Dig. 1959 : **14** : 35–36.

The above varieties were introduced by the New York Agricultural Experiment Station in 1959. Fletcher (Midland x Suwannee) combines high yield, firmness and high quality for domestic use and freezing. It ripens slightly later than Sparkle. Frontenac [Erie x (Fairfax x Dresden)] is recommended for commercial testing on account of its productiveness, late ripening, firmness and freezing quality. It ripens a few days later than Sparkle. Ripening shortly after Catskill, Fulton (Starbright x Pathfinder) was introduced for trial because of its outstandingly high degree of firmness. Satisfactory for freezing, it is not however equal in this respect to the other two new varieties and Sparkle.

3158 **Cyclone strawberry.**
Amer. Nurserym. 1960 : **111** : No. 1 : p. 119.

Denisen, E. L.
Cyclone—a new strawberry for your garden.
Iowa Fm. Sci. 1959 : **14** : 393–94.

Cyclone, a large-fruited June-bearing variety recommended only for domestic gardens or production for local markets, was developed from Rockhill selfed x (Beaver x Dorsett) at Iowa State College, Ames.

3159 Matzner, F.
Über den Vitamin-C-Gehalt in Erdbeeren (*Fragaria grandiflora* Ehrh.). [**On the vitamin-C content of strawberries (*P. grandiflora* Ehrh.)**].
Wiss. Z. Univ. Jena : Math.-Naturwiss. Reihe 1958 (1959) : **8** : 252–59.

In tests of 15 varieties during 1954–58, varietal differences in contents of ascorbic acid and "total vitamin C" (ascorbic acid + dehydrascorbic acid) were found. Georg Soltwedel had the highest content of vitamin C with 94 mg./100 g. fresh weight and 817·5 mg./100 mg. dry weight, followed by Sachsen with the corresponding values 84·5 mg. and 786·8 mg.; most other varieties had 30–60 mg. and 400–700 mg. respectively. Differences between years and between localities varied according to variety. A significant negative correlation ($r = -0{\cdot}767$) between total acids and vitamin C content was detected.

3160 Tarnovska, K.
(The vitamin C content in strawberries).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1958 : **5** : 329–38. [Bulgarian].

The vitamin C content was determined in fruit of seven varieties cultivated in the ordinary way and of one variety treated with various doses of fertilizer. Eva Macherauch had the highest vitamin C content; the vitamin C content of Madame Moutot was not affected by the different fertilization treatments.

3161 Kronenberg, H. G., Braak, J. P. & Zeilinga, A. E.
Poor fruit setting in strawberries. II. Malformed fruits in Jucunda.
Euphytica, Wageningen 1959 : **8** : 245–51.

Fruit set in Jucunda clones, particularly clone JK3, was poorer in exposed than in mild sheltered localities; interplanting with the good-pollen variety Deutsch Evern slightly reduced the percentage of nubbins. Pollination tended to be lower in closely planted beds and was not increased by the presence of bees. Anther development was poor in Jucunda, especially in clone JK3, and pollen production and quality were low; pollen quality was however not clearly related to anther development and varied with locality, year and time of flowering. Meiosis and tetrad production in JK3 anthers were normal. In phytotron experiments, fruit set in Jucunda was good only at 17–26° C. and dropped to zero below 14° C., while Deutsch

Evern gave good fruit sets over the whole range 10–26° C.

3162 Stembridge, G. & Scott, D. H.
Inheritance of resistance of strawberry to the common race of the red stele root rot fungus.
Plant Dis. Reptr. 1959 : **43** : 1091–94.

Resistance tests on seedling strawberry progenies and on parent varieties indicate that the inheritance of resistance to race A–1 of *Phytophthora fragariae* is quantitative and partially dominant. Varieties tested owed their resistance to the presence of Aberdeen or Frith in their parentage and the results indicate that resistance from these two sources acts independently.
There is evidence also that resistance to race A–1 from Aberdeen-type parents is transmitted to a greater proportion of the progeny than is resistance to race A–3 from Frith-type parentage.

3163 Daubeny, H. A.
Relative resistance of some strawberry varieties, species, selections and seedling populations to powdery mildew at Agassiz and Abbotsford, British Columbia.
Plant Dis. Reptr. 1959 : **43** : 1253–55.

The highest degree of resistance to *Sphaerotheca macularis* was found in Siletz, Agassiz 90 and 92, Temple x Or.2172, *Fragaria chiloensis* selections from Vancouver Island and Oregon, and *F. ovalis*.
Resistance in seedling populations was greatest in those derived from the cross Siletz x Puget Beauty.

3164 Miller, P. W. & Waldo, G. F.
The virus tolerance of *Fragaria chiloensis* compared with the Marshall variety.
Plant Dis. Reptr. 1959 : **43** : 1130–31.

Several clones of *Fragaria chiloensis* were all found to be uninjured by the principal Northwest strawberry viruses, although the virus or virus complex introduced was in each case recoverable by grafting into a susceptible indicator. The same viruses caused visual leaf symptoms in the variety Marshall.

3165 Miller, P. W.
An improved method of testing the tolerance of strawberry varieties and new selected seedlings to virus infection.
Plant Dis. Reptr. 1959 : **43** : 1247–49.

Selected strawberry seedlings were inoculated with individual viruses and with virus components by the excised leaf-petiole graft technique. Symptoms generally appeared in 3–9 weeks.
Virus tolerance can be broken down if a sufficient number of components are introduced into the plant. U.S.–Oreg. 2433 is tolerant to latent A, latent C, mottle, crinkle, vein banding and mild yellow edge when introduced singly, but susceptible to combinations of these; US.–Oreg. 2426 showed tolerance to the whole complex, but is nevertheless not immune.

3166 Frazier, N. W.
Differential transmission of nineteen variations of strawberry mottle virus by *Aphis gossypii* Glover.
Plant Dis. Reptr. 1960 : **44** : 12–13.

The variants of strawberry mottle virus are distinguished by the ability of *A. gossypii* to transmit them. Only one of the six curly-dwarf variants is transmitted and that inefficiently.

3167 Cox, E. A., Stotzky, G. & Goos, R. D.
***In vitro* culture of *Musa balbisiana* Colla embryos.**
Nature, Lond. 1960 : **185** : 403–04.

Developed at the Central Research Laboratories, United Fruit Co., Mass., a successful method of embryo culture of *M. balbisiana* is described. The technique could possibly be applied to other varieties of banana in breeding and other studies.

3168 Philippe, J.
La culture bananière en Guinée, en Côte d'Ivoire et au Cameroun. (**Banana cultivation in Guinea, the Ivory Coast and the Camaroons**).
Bull. agric. Congo belge 1959 : **50** : 957–97.

The variety Gros Michel is to be replaced by Poyo which is suitable for intensive cultivation and is resistant to Panama disease.
Of sixty varieties tested for resistance to *Cercospora musae*, only Yangambi Km5 was resistant. Poor fruit quality however makes this variety unsuitable for the export market.

3169 Oprea, St.
Observaţii asupra culturii cîtorva soiuri de viţă de vie în condiţiile de la Cluj. (**Observations on the cultivation of some vine varieties under the conditions of Cluj**).
Grădina Via Livada 1958 : **7** : No. 10 : 30–32.

A trial of 20 varieties grafted on Berlandieri x Riparia Kober 5BB is reported, data being

presented on cane growth and sugar content of the juice.

3170 Popescu, G.
Comportarea soiurilor de viţă roditoare, altoite şi pe rădăcini proprii, în condiţiile podgoriei Odobeşti. (**The behaviour of grafted and own-rooted grape varieties under the conditions of the Odobeşti vineyard**).
Lucrăr. şti. Inst. Cercet. hort.-vit. Băneasa-Bucureşti 1957 (1959) : 401–09.
Data are provided on the growth of 30 Rumanian varieties (1) grafted on Riparia Gloire and (2) grown on their own roots.

3171 Rožanec, G. M.
(Central Asiatic vine varieties in the Crimea).
Vinodelie Vinogradarstvo SSSR (Winemak. & Vitic. USSR) 1959 : No. 6 : 37–38. [Russian].
Descriptions are given of 11 oriental vine cultivars which showed most promise in introduction trials at the Koktebel' state farm, Crimea. Terbaš and Kara-uzjum [Black grape] are dual-purpose dessert and wine varieties; all the others are dessert cultivars. Kišmiš Černyj [Black Sultana] is seedless and several varieties from Uzbekistan are characterized by large bunches and good transportability.

3172 Calzecchi-Onesti, F.
La precoce "Cardinal" uva da tavola di sicuro avvenire. (**The early "Cardinal", a dessert grape with a definite future**).
G. Agric. 1959 : **69** : p. 420.
The parentage of the Cardinal grape [cf. XXVII, 3452] is now given as Amheur ben Amheur x Ribbier (Flame Tokay x Alphonse Lavallée).

3173 Bruni, B.
Vesprino.
Ann. Sper. agr. 1959 : **13** : No. 6 : Suppl. : i–x.
The vine described is an ancient variety of unknown origin, grown in relatively small quantities in northern Italy for wine making.

3174 Bruni, B.
Empibotte bianco. (**White Empibotte**).
Ann. Sper. agr. 1959 : **13** : No. 6 : Suppl.: xi–xvii.
This ancient vine exists under a wide variety of synonyms, many of which testify to its high productivity, on account of which it is still grown in central Italy, in spite of the inferior quality of the wine it produces.

3175 Bruni, B.
Maiolica.
Ann. Sper. agr. 1959 : **13** : No. 6 : Suppl. : xix–xxvi.
An ancient vine of central Italy, the variety is used for mixing with others to improve the colour of the wine.

3176 Bruni, B.
Sagrantino.
Ann. Sper. agr. 1959 : **13** : No. 6 : Suppl. : xxvii–xxxv.
The vine described, thought to be of local origin, is confined to the Perugia province of Italy, where it is used for making a sweet aromatic wine said to possess medicinal properties.

3177 Bruni, B., del Gaudio, S. & de Girolamo, S.
Bombino bianco. (**White Bombino**).
Ann. Sper. agr. 1959 : **13** : No. 6 : Suppl. : xxxvii–xlvi.
This vine, the origin of which is unknown, exists under a large number of synonyms in southern Italy; it is highly productive and is used for the preparation of an agreeable white wine and for vermouth.

3178 Dalmasso, G., dell'Olio, G. & Bertola, G.
Erbaluce.
Ann. Sper. agr. 1959 : **13** : No. 6 : Suppl. : xlvii–lvi.
The vine in question, also known as Albaluce on account of its white, slightly copper-coloured grapes, has been grown since ancient times in Piedmont, though its origin is uncertain. It is used for preparing a sweet dessert wine as well as for dry wines, white and rosé.

3179 Dalmasso, G., dell'Olio, G. & Delleani, E.
Avarengo.
Ann. Sper. agr. 1959 : **13** : No. 6 : Suppl. : cxcix–ccvi.
The vine described is grown in the Piedmont area of Italy, mainly for mixing with other varieties in wine making.

3180 Dalmasso, G., dell'Olio, G. & Delleani, E.
Doux d'Henry.
Ann. Sper. agr. 1959 : **13** : No. 6 : Suppl. : ccvii–ccxvi.
Of unknown origin, this vine is thought to have originated in the Piedmont area of Italy, where it is mainly eaten fresh.

3181 Dalmasso, G., dell'Olio, G. & Delleani, E.
Plassa.
Ann. Sper. agr. 1959 : **13** : No. 6 : Suppl. : ccxvii–ccxxiii.

Of unknown origin, this vine is used in the Piedmont area of Italy both for dessert, on account of its thick skin and consequent keeping capacity, and for mixing with other varieties in making wine.

3182 Hë-Pu-Čao [Heh, P.-C.]
(Viticulture in People's China).
Vinodelie Vinogradarstvo SSSR (Winemak. & Vitic. USSR) 1959 : No. 6 : 46–48. [Russian].

The principal varieties in cultivation are listed and eight varieties native to China are described. All ripen in midseason and are dessert types except Lung-yen [Dragon's Eyes] and Heh-chi-hsin [Black Chicken Heart] which are also used for wine making. Most have large bunches and berries. Pai-chi-hsin [White Chicken Heart] is fairly resistant to frost, insects and diseases.

3183 Krishnamurthi, S., Randhawa, G. S. & Singh, J. P.
Effect of gibberellic acid on fruit set, size and quality in the Pusa seedless variety of grapes (*Vitis vinifera* L.)
Indian J. Hort. 1959 : **16** : 1–4.

Pusa Seedless is a new grape variety presently under trial at the Indian Agricultural Research Institute, New Delhi. The berries are said to be green to yellowish in colour, short-oval, small, superior in taste and flavour and to contain 20–22% total soluble solids. It bears a medium to heavy crop which ripens in mid-June.

Spraying with an aqueous solution of potassium gibberellate was found to increase berry size without affecting fruit quality.

3184 Hilpert, G.
Untersuchungen am Pachytän von *Vitis vinifera* L. **(Investigations on pachytene in *V. vinifera* L.).**
Vitis 1959 : **2** : 79–83.

Riesling 90 and the tetraploid mutants G. Riesling 5 and 7 were studied. In addition to the satellite chromosome mentioned in previous work [cf. XXVIII, 4708], three more chromosomes have been distinguished; these can be recognized by the arrangement and size of their chromomeres; in each case only part of the chromosome has been seen and total lengths are not known. Pachytene chromosomes appeared to be normal in structure. In metaphase II, the two equational plates were found to be perpendicular to each other except in G. Riesling 5, where they were in the same plane, indicating that there was some disturbance of the spindle during anaphase I in the tetraploid. In pollen mitosis of G. Riesling 7, much clumping of the chromosomes was observed and this may account for the poor fertility of the mutant.

3185 Enin, T. K.
(Obtaining polyploid shoots in the vine).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 10 : 66–69. [Russian].

In studies at the Moldavian Institute of Horticulture and Viticulture, a young plant of Portugieser was induced to develop tetraploid shoots by treatment with a 0·05% solution of heteroauxin. The tetraploid came into bearing one year earlier than the diploid, was more productive and had larger bunches and berries. A table provides fuller information on differences in quantitative and qualitative characters between the tetraploid and diploid forms. Mention is also made of a spontaneous polyploid of Portugieser found in the same vineyard. The above polyploids are thought to be valuable both as new varieties of Portugieser and as breeding material.

3186 Alleweldt, G.
Das vegetative Wachstum 1 jähriger Reben in Abhängigkeit von der Tageslänge. **(The vegetative growth of one-year old vines depending on the length of day).**
Vitis 1959 : **2** : 101–12.

Short-day treatment inhibited growth. The varieties FS4–201–39 and Riesling 90 were best able to withstand this treatment, whilst FS4–195–39 and Riparia G80 were the most susceptible; Sbl2–19–58 showed an intermediate reaction. In general short-day treatment promoted the ripening of the wood. There were marked varietal differences in time of ripening, this being particularly early for FS4–195–39 and late for Riparia G80. The reaction to short photoperiod is discussed in relation to the formation and activity of growth regulating substances.

3187 Harmon, F. N. & Weinberger, J. H.
Effects of storage and stratification on germination of *vinifera* grape seeds.
Proc. Amer. Soc. hort. Sci. 1959 : **73** : 147–50.

In experiments undertaken at the US Horticultural Field Station, Fresno, Calif., with the aim of improving germination of seeds used in breeding, outdoor stratification or moist after-ripening treatment in a refrigerator (33°–40° F.)

had a beneficial effect upon germination. Varieties differed in their response to a given period of after-ripening.

3188 Popa, E. & Basamac, C.
Maturarea strugurilor la principalele soiuri din podgoria Drăgăşani în anii 1951–1957. (**The maturation of the grapes of the principal varieties of the Drăgăşani vineyard during the years 1951-57**).
Lucrăr. şti. Inst. Cercet. hort.-vit. Băneasa-Bucureşti 1957 (1959) : 443–55.
Maturation dates of 20 locally grown varieties are given.

3189 Rivals, P.
Sur la coulure de la vigne. (**Shedding in vines**).
Ann. Éc. nat. supér. agron. Toulouse 1958 : **6** : 65–70.
The term "shedding" is used here to cover those physiological disturbances which result in the defective development of one or more of the floral organs, as a result of which the buds, flowers or young fruits are subsequently dropped. Fruit drop, or *millerandage*, is thus one particular form of shedding. Examples are given of commercial varieties and selections exhibiting the various manifestations described.

3190 Ribéreau-Gayon, P.
Recherches sur les anthocyannes des végétaux application au genre *Vitis*. (**Research on the anthocyanins of plants. An application to the genus *Vitis***).
Rev. gén. Bot. 1959 : **66** : 531–635.
The anthocyanins of the fruit of 15 species from different parts of the world were investigated by chromatography. Most species contained both monoglycosides and diglycosides but *V. rotundifolia* had only diglycosides and *V. monticola* and *V. vinifera* only monoglycosides. Varieties of *V. vinifera* showed very little difference in the relative proportions of the different pigments present. The occurrence of diglycosides was dominant to absence of diglycosides.

3191 Ribéreau-Gayon, P.
Les anthocyannes du genre *Vitis*. Application à la différenciation des vins. (**The anthocyanins of the genus *Vitis*. Application to the differentiation of wines**).
CR Acad. Sci., Paris 1960 : **250** : 591–93.
The following observations are reported: (1) anthocyanic diglycosides, as detected by paper chromatography, are never found in the berries of *V. vinifera* but are characteristic of those of *V. riparia* and *V. rupestris*; and (2) the presence of diglycosides behaves as a dominant in crosses. The presence of diglycosides in a cultivated grape or wine is thus evidence of its hybrid origin although their absence does not indicate pure *V. vinifera* parentage.

3192 Dragaš, M., Avramov, L. & Milosavljević, M.
(**A contribution to the study of the morphological characteristics and seed dimensions of some vine varieties**).
Zborn. Rad. poljoprivred. Fak./Rev. Res. Wk. Fac. Agric., Beograd 1958 : **6** : 135–50. [Serbian].
Some varieties were found to differ markedly in the shape and appearance of the seed; in certain cases, these characters were constant and could be used for identification. Seed dimensions and weight varied with locality, year and variety.

3193 Breider, H., Reuther, G. & Wolf, E.
Untersuchungen zum Qualitätsproblem bei Reben-Hybriden. (**Investigations on the quality problem in grape hybrids**).
Züchter 1959 : **29** : 317–34.
When hens were given wine from disease-resistant hybrid vines (*Vitis vinifera* x wild American species) and no other fluid for several months, liver disorders and changes in the erythrocytes and composition of the blood serum occurred in high frequency, whereas these diseases were much rarer in birds which had drunk water or wine from nonhybrid vines during the same period.

3194 Lju-Juj-Jan' [Liu, Y.-Y.]
(**Studying the firmness of grapes against pressure and their attachment to the fruit stalks**).
Vinodelie Vinogradarstvo SSSR (Winemak. & Vitic. USSR) 1959 : No. **6** : 41–45. [Russian].
In studies of the grapes of different vine varieties at the Timirjazev Agricultural Academy, the firmness of the berry was positively correlated with the strength of attachment to the stalk, these characters being associated with the consistency of the flesh, size of berry, thickness of cell walls and the contents of cellulose and protopectin in the flesh. Hybrids between varieties with different consistencies usually bore juicy berries with intermediate firmness and intermediate strength of attachment to the

stalk. Some hybrids, however, were firmer than their parents. Such hybrids predominated among the progeny of Ičkimar x Pobeda [Victory] and Kaš Uzjum [Kaš grape] x Karmannyj [Pocket].

3195 Najdenova, I. N.
(Developing high-quality mildew resistant vines).
Sborn. Trud. moldav. Sotrudnik. vsesojuzn. Inst. Zaščit. Rasten. [Rep. Wk. Moldav. Inst. Pl. Prot.] 1957 : No. 2 : 45–50 : from Ref. Ž. (Ref. J.) 1958 : No. 17 : Abst. 77865 : p. 196. [Russian].

Seedlings 1 and 2 of *Vitis vinifera* have been selected for mildew resistance and other valuable economic characters under conditions of artificial infection. Seedling 1 had 41·7% leaves free from disease and seedling 2 had 91%. Vegetative and sexual hybrids of the above seedlings with the less resistant older varieties showed a reduction in resistance.

3196 Ajvazjan, P. K. & Dokučaeva, E. N.
(New resistant forms of vine in the Ukraine).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 10 : 64–66. [Russian].

The most valuable characteristics of 1–29–60 (Sereksija x Rupestris du Lot), 1–38–47 (Sereksija x Riparia x Rupestris 3309) and 13–2–11 [(Sereksija x *Vitis amurensis*)/Rupestris du Lot], bred at the Tairov Viticultural Institute, are the high quality of their dessert wine and their resistance to frost and mildew.

3197 Šterenberg, P. M.
(The nature of spot necrosis).
Vinodelie Vinogradarstvo SSSR (Winemak. & Vitic. USSR) 1959 : No. 7 : 28–33. [Russian].

Fungous infection with *Rhacodiella cactanea* (*Sclerotinia pseudotuberosa*) was found to be responsible for the above pathological condition of the wood on vines at the Ukrainian Viticultural Institute. Cabernet-Sauvignon, Činuri, Rkaciteli and a few other varieties showed a fair degree of resistance.

3198 Geisler, G.
Untersuchungen zur Resistenzzüchtung gegen "Heuwurm"-Befall bei Reben. **(Investigations on breeding for resistance to attack by moth larvae in grapes).**
Vitis 1959 : **2** : 84–100.

A large number of seedlings of interspecific crosses was investigated. Resistance to *Clysia ambiguella* and *Polychrosis botrana* was found to be correlated with compact bunches, few hairs on the bunches, rapid development of the grapes, small prophylls and an exposed situation for the fruit on the plant. The most resistant seedlings had all these characters strongly expressed. It is thought that there are no specific resistance characters such as an odour repelling the insects. Crosses of *Vitis riparia* and *V. rupestris* were more resistant than crosses of *V. labrusca* and of G157 (*V. solonis* x Riesling). As regards the *V. vinifera* varieties, the crosses with Riesling were on an average more severely attacked than those of Sylvaner and Gutedel.

3199 Rusiašvili, I. L.
(The results of studying *Phylloxera* resistance of several Georgian vine varieties).
Vinodelie Vinogradarstvo SSSR (Winemak. & Vitic. USSR) 1959 : No. 7 : 27–28. [Russian].

Cicka, Rkaciteli, Činuri and Mcvane Kahetinskij [Kahetian Mcvane] were the most resistant among the varieties tested at Telavi, Georgia.

FOREST TREES

3200 Wright, J. W. & Freeland, F. D.
Plot size in forest genetic research.
Pap. Mich. Acad. Sci. 1958 : **44** : 177–82.

In uniformity trials conducted on red pine and yellow poplar plantations in southern Michigan, a rapid decrease in statistical efficiency was recorded with increasing plot size.

3201 Rohmeder, M.
Forstgenetik und Forstpflanzenzüchtung in der Bibliographie des Oxfordsystems. **(Forestry genetics and forest tree breeding in the bibliography of the Oxford system).**
Silv. genet. 1959 : **8** : 109–11.

The Oxford system of classifying literature on the breeding and genetics of forest trees is criticized and an alternative system is suggested.

3202 Bouvarel, P.
Les repeuplements artificiels — conséquences d'ordre génétique. **(Artificial reafforestation—some genetical consequences).**
Schweiz. Z. Forstw. 1958 : **109** : 524–36.

Reafforestation may lead to (*a*) hybridization of the introduced population with local trees of different species or varieties, with resulting changes in the hereditary constitution of the stand, and (*b*) changes in the introduced material through the action of the natural selection resulting from environmental differences between the new locality and the place of origin.

The first effect may be deleterious or not, while the second, since it results in improved adaptation, is likely to be useful. Examples of both effects are cited.

3203 MATTHEWS, J. D.
La sélection et la classification des arbres en génétique forestière. (**The selection and classification of trees in forestry genetics**).
Schweiz. Z. Forstw. 1958 : **109** : 478–94.

The above topics are discussed in general terms under the following headings: the aims of selection; the organization of a breeding programme; the study of variation; selection criteria; selection of trees of exceptional quality; sampling and selection; estimation of growth, health and quality; registration and protection of selected trees; and classification of selected trees.

6. Tagung der Arbeitsgemeinschaft für Forstgenetik und Forstpflanzenzüchtung 1958. (**6th meeting of the Study Group for Forestry Genetics and Forest Plant Breeding, 1958**).
Silv. genet. 1959 : **8** : 123–25.

3204 *Grehn, J. Neue mikroskopische Methoden in Genetik und Züchtung.* (*New microscopic methods in genetics and breeding*). (*pp. 123–24*).

Mention is made of physical and chemical techniques which have proved valuable in cytological work. These include interference microscopy which makes possible the determination of very small quantities of dry matter. Changes in water and dry-matter content during meiosis and mitosis have been investigated. Adsorption photometry has provided information on the distribution of nucleic acids and proteins in the cell.

3205 *Kleinschmit, R. Eine Mendelspaltung bei der europäischen Lärche.* (*A Mendelian segregation in the European larch*). (*p. 124*).

Growth and branching were compared in seedlings and vegetatively-produced progenies of plus trees, hybrids from a controlled cross between two plus trees and various other trees. Three types of tree were distinguished: (1) trees with a narrow angle between side branches and the main stem, the best growth in height and little variability; (2) well-grown trees with wider angles between side branches and the main stem and more variability and (3) trees with very poor growth and in some cases a drooping habit. The allele for straight tall growth is designated *H* and that for low growth *h*, whilst alleles for narrow and wide branching angles are designated *Z* and *z* respectively. The nine possible genotypes could be distinguished in progenies from indigenous stands in three districts and in the controlled cross.

3206 *Seitz, F. W. Einige Erfahrungen bei der Anzucht von Aspensämlingen.* (*Some experiences in raising aspen seedlings*). (*pp. 124–25*).

With diallel crosses it is often impossible to obtain all the progenies in one season. The work may however be divided between two seasons. By cutting back the oldest seedlings twice and the youngest seedlings once, it may be possible to bring both groups to the same stage of development before performance trials are carried out.

3207 *Stern, K. Über einige Experimente zur Artfrage bei Sand- und Moorbirke.* (*Some experiments on the species question in* Betula verrucosa *and* B. pubescens). (*p. 125*).

B. verrucosa and *B. pubescens* are sympatric in certain areas but they remain distinct species. As regards cross compatibility, individual clones have shown marked differences which are inherited; also environmental conditions at the time of fertilization affect the result. Differences in chromosome number are not thought to play any part in the incompatibility, which is probably genetic. Back crosses of hybrids to both parents have been obtained and therefore a little introgression may have occurred in the past. Some hybrids have shown weakness which has a variety of causes. *B. pubescens* may be an allotetraploid in whose ancestry a species similar to *B. verrucosa* and another unknown species are involved. This second species may be *B. medwedjewii*, for *B. pubescens* is intermediate between *B. medwedjewii* and *B. verrucosa* in several characters. *B. verrucosa* and *B. medwedjewii* can be easily crossed artificially but under natural conditions they bloom at different times. In some regions east of the Black Sea, *B. medwedjewii* occurs with *B. verrucosa* and *B. pubescens*.

3208 SCHELL, G.
Organisatorische und technische Voraussetzungen zur Prüfung der Nachkommenschaften der Plantagenklone. (**Organization and technical requirements for testing progenies of plantation clones**).
Silv. genet. 1959 : **8** : 148–49.

Brief details are given of methods of progeny testing used with forest trees in Bavaria.

3209 Johnsson, H.
Föreningen Skogsträdsförädling. Aktuellt från sydöstra distriktet. **(The Forest Tree Breeding Association. News from the south-eastern district).**
Skogen 1960 : **47** : 79, 87.

Seed plantations of Scots pine, spruce, hybrid larch, oak and beech have been established in south-eastern Sweden. Progeny trials of some of the material in the plantations have begun.

3210 Syrach Larsen, G.
Angewandte Genetik im Waldbau. **(Applied genetics in forestry).**
Schweiz. Z. Forstw. 1958 : **109** : 433–57.

In this general outline of some of the principles of forest-tree breeding, mention is made of an oak found in Denmark which is resistant to *Microsphaera quercina*, resistance being due to escape, since no lammas shoots are formed. A form of *Pseudotsuga taxifolia*, resistant to *Chermes cooleyi* is also referred to; it may prove useful for the production both of resistant grafts and of resistant seed. The value of grafted material for seed production and hybridization is stressed.

3211 Bayne Snyder, E.
Comments on "The divergent points of view of forest geneticists and of agronomic and horticultural plant breeders".
J. For. 1959 : **57** : 666–68.

The author accepts most of the ideas put forward by Inman in the article referred to above [cf. XXIX, 4474] as being constructive and worthy of further consideration. On some points there is however disagreement. It is pointed out that forest-tree breeders are now aiming at heterogeneity and not devoting too much attention to selecting "too close to type". Also they are not neglecting progeny testing, although phenotypic characters and the performance of ancestors and relatives are all taken into consideration when selecting. The usefulness of seed orchards in progeny testing is indicated but it is thought that many more trees should be tested than is possible in seed orchards and combining ability should be examined by a one-parent progeny test. Preferably all selections should be preserved by grafting. Inman's statement that basic genetic knowledge of forest species is not necessary for their improvement is thought to be dangerous, for such basic knowledge is essential for progress.

3212 Rubner, K.
Zum Baumrassenproblem in Mitteleuropa. **(On the problem of tree races in Central Europe).**
Schweiz. Z. Forstw. 1956 : **107** : 217–25.

Trees of the eastern Baltic, in particular birch, alders, aspen and to some extent hornbeam, are superior to those of central Europe in growth and form and many, especially the pine races, maintain their good characters when planted in central Europe. Similarities to the Baltic trees are found among the pines of the Fichtelgebirge and the Black Forest, the alder of upper Bavaria and the larches of the Wienerwald, Poland and the Sudeten; these populations in central Europe are regarded as relicts of larger populations left, chiefly in mountain areas, after the retreat of the ice.

3213 Worsley, R. G. F.
The processing of pollen.
Silv. genet. 1959 : **8** : 143–48.

Techniques used for collecting, ripening, extracting, storing and testing pollen are described. Pollen of many species of coniferous and broad-leaved trees has been artificially ripened by subjecting the developing male flowers to conditions of increased day-length, light intensity and warmth in a very humid atmosphere. In testing pollen viability by germination, it was found that solutions of hydrogen peroxide of strengths between 0·1% and 0·01% stimulated the pollen to germinate quickly even under unfavourable conditions. A vital-staining technique for determining viability is described; this involves mounting the pollen in a mixture of glycerine jelly, methyl green and phloxin [cf. XXIII, 101]. This method may be used in the field.

3214 Ozolin, G. P.
(The problem of breeding forest trees for immunity from diseases and pests).
Les. Hoz. (Forestry) 1960 : No. 2 : 28–31. [Russian].

Observations by various Soviet workers on interspecific differences in resistance to pests and diseases of the following forest trees are reported: the resistance of *Quercus* spp. to *Oidium*, *Populus* spp. to *Pseudomonas*, *Melampsora*, *Fusicladium* and *Cytospora*, *Fraxinus* spp. to *Oidium*, *Pinus* spp. to leaf cast, and *Larix* spp. to *Meria* needle cast. In addition to the above, the following practical achievements in resistance breeding are mentioned.

Poplar. Forms resistant to *Fomes ignarius* have been selected and are being used as initial material for vegetative or sexual reproduction on forest farms in European Russia. The resistant forms include two giant triploids of *P. tremula*, a specimen with ♂ flowers found in the Gor'kij province in the '30s and a ♀ specimen discovered more recently in the Kurgan province. The others are normal diploids found in White Russia; they are distinguishable from the susceptible forms by their green bark. Interspecific hybrids of poplar bred at the Uzbek Forestry Institute distinguished by quick growth are listed. Some of these, such as Pervenec Uzbekistana [Uzbekistan First-born] and Stremitel'nyj [Impetuous], both from pollination of a local form of *P. alba* by triploid *P. tremula* from the province of Gor'ki, are resistant to *Cytospora* and also to convex scale.
Elm. Mention is made of hybrids bred in Uzbekistan which are resistant to Dutch elm disease. All of them derived their resistance from *Ulmus pinnato-ramosa*.

3215 Stefanov, B. & Nedjalkov, S.
(*Quercus thracica* nov. spec.—arbor memorabilis).
Izv. bot. Inst. (Bull. bot. Inst.), Sofija 1956 : **5** : 39–54. [Bulgarian].
A Latin description of the above new species found in Bulgaria is given.

3216 Li, C.-V. [Li, T.-W.]
(The forms of *Populus nigra* in Baškiria).
Les. Hoz. (Forestry) 1960 : No. 1 : 15–18. [Russian].
Three biotypes found in Baškiria are distinguished by superior timber quality, rate of growth, type of branching and other morphological and economic characteristics. One of them, with dark bark, is economically less valuable than the other two, especially the biotype with grey-yellow bark, which is greatly superior to the first in rate of growth and the quality of its timber for the manufacture of paper and cellulose. The third biotype has a narrow pyramidal crown resembling *P. berolinensis*; it is characterized by a straight bole and quick growth and is valuable for its high timber yield; alternatively it can be grown for ornamental purposes.

3217 Sacre, E.
Le bois de tension des peupliers. **(Tension wood of poplars.)**
Bull. Inst. agron. Gembloux 1959 : **27** : 435–44.
Species differences in the percentage of gelatinous fibres in the tension wood were as follows: *P. robusta* 67·3%, *P. marilandica* 36·0%, *P. serotina* 35·2% and *P. regenerata* 27·3%.

3218 Watanabe, S. & Ohki [Oki], M.
(A new species of *Betula* from Hokkaido).
Shokubutsu Kenkyu Zasshi/J. Jap. Bot. 1959 : **34** : 329–32. [Japanese].
A description is given of *B. tatewakiana*, a thick-leaved type restricted, as far as is known, to the Sarabetsu moor.

3219 Richens, R. H.
Studies on *Ulmus*. III. The village elms of Hertfordshire.
Forestry 1959 : **32** : 138–54.
This survey, on parallel lines to an earlier survey of southern Cambridgeshire [XXIX, 764], deals with 143 samples. From a comparative study of eight quantitative foliar characters, most of the samples could be assigned to one of 9 biometrically defined groups, 7 pertaining to *U. carpinifolia* and 2 to *U. procera*. The *U. carpinifolia* groups are principally found in the east of the county and are regarded, in some cases at least, as of Roman origin. *U. procera*, within which intraspecific races are now recognized, is believed to have had a threefold origin in this area: (1) from the Thames valley, (2) from the Icknield zone, and (3) from a local centre around St. Albans. *U. procera* had become established before the end of the Middle Ages but its introduction has not yet been dated.

3220 Trofimov, T.
(Some species of *Sorbus*).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 12 : 48–49. [Russian].
Mention is made of some forms in the collection of the Botanic Garden of Moscow University and of large-fruited varieties selected in Vladimir and Ivanov provinces. One of these latter varieties, Saharnaja [Sugar], has a sugar content of 13·1% as against 4·29% in the common wild form.

3221 Ortmann, C.
Beobachtungen über das Vorkommen autochthoner, baumförmiger Salix-Spezies und ihre Bedeutung für die Forstpflanzenzüchtung. **(Observations on the occurrence of indigenous arborescent *Salix* species and their importance for forest-tree breeding).**
Silv. genet. 1959 : **8** : 133–37.
The variation in form of *Salix* species in three

stands growing in markedly different environments in Germany is described; the observations were mainly confined to *S. alba*, *S. pentandra* and *S. caprea*. At Rhinluch, trees of *S. pentandra* were found; this species has usually a shrubby habit, trees being rather rare. Information is given on the wood production of two plus trees of *S. pentandra*, which have given better results than alder of the same age. Amongst the various forms of *S. caprea* found in Breitenberg, were some with particularly straight trunks. The results of these investigations indicate that there is some ecological specialization amongst indigenous species of *Salix*. The value of the different species is briefly discussed and suggestions made for future breeding work.

3222 Czeika, G. & Schiman, H.
Die Chromosomen von *Ginkgo biloba*. (**The chromosomes of *G. biloba***).
Öst. bot. Z. 1960 : **107** : 1–5.

Idiograms from male and female plants in the Botanical Garden of the University of Vienna were identical. Ten of the twelve chromosomes of the haploid set were anisobrachial and the other two almost isobrachial. Two satellites were observed; one was attached to the long arm of an anisobrachial chromosome and one to the longest isobrachial chromosome.

3223 Miller, W. E. & Heikkenen, H. J.
The relative susceptibility of eight pine species to European pine shoot moth attack in Michigan.
J. For. 1959 : **57** : 912–14.

Five to ten trees of each species were studied in each of six plantations infested with *Rhyacionia buoliana*, counts being made of the number of pupae and number of shoots per tree. Mean insect/shoot ratios were compared. On the basis of these ratios, *Pinus virginiana*, *P. rigida*, *P. banksiana* and *P. strobus* were found to have low susceptibility, *P. ponderosa*, *P. nigra* and *P. sylvestris* medium susceptibility and *P. resinosa* high susceptibility.

3224 Wettstein, W.
Rassen- und Züchtungsforschung bei *Pinus silvestris*. (**Research on races and breeding in *P. silvestris***).
Schweiz. Z. Forstw. 1958 : **109** : 495–505.

Some results of provenance trials and breeding work since 1930 are reviewed and the following observations recorded. Single-tree progenies of 100 trees in Müncheberg showed differences in attack by *Lophodermium*, rate of growth and amount of nibbling by wild animals. In crosses between trees of different provenance, heterotic F_1 generations were obtained. Other heritable characters found in pine were: tolerance of shade; amount of resin (in *P. nigra*); 100-seed weight, which is related to cotyledon number and probably also to seedling growth; thermoperiodic and photoperiodic behaviour; and resistance to frost. In crosses of *P. nigra* with *P. sylvestris*, the levorotatory terpentine oil of the latter was dominant over the dextrorotatory oil of the former.

3225 Callaham, R. Z.
Better trees through systematic breeding.
Proc. Ann. Mtg. Nat. Shade Tree Conf. 1957 (1958) : **33** : 272–75.

By combining the insect resistance of *Pinus coulteri* with the high timber quality of *P. jeffreyi*, a hybrid of acceptable commercial value and with seven times the insect resistance of the *P. jeffreyi* parent has been obtained.
A hybrid which is resistant to drought and frost, and which is capable of rapid growth without loss of wood quality, has been developed by crossing the slow-growing but drought-resistant knobcone pine (*P. attenuata*) with the rapidly-growing but frost-susceptible Monterey pine (*P. radiata*).

3226 Mergen, F.
Applicability of the distribution of stomates to verify pine hybrids.
Silv. genet. 1959 : **8** : 107–09.

An analysis of the distribution of stomata on the needles was found to be a valid test for identifying putative hybrids of *Pinus thunbergii* x *P. densiflora*, *P. densiflora* x *P. nigra* and *P. monticola* x *P. strobus* but not for *P. ayacahuite* x *P. strobus*, for in this last case, the means for stomata per unit length and the frequency distribution curves were very similar in both parents. Seedlings resulting from open pollination of *P. nigra* were analysed and the results indicated that some of the progeny was of hybrid origin.

3227 Callaham, R. Z. & Metcalf, W.
Altitudinal races of *Pinus ponderosa* confirmed.
J. For. 1959 : **57** : 500–02.

Measurements were made on 20-year old trees of *P. ponderosa* and *P. jeffreyi* grown in the North Coast Range of California. With one exception, trees grown from seed collected at high elevations tended to grow more slowly than those originating from seed collected in lower districts. [Cf. XXIII, 1510].

3228 Stastny, T.
Az 1909–1912-ben létesített erdeifenyő származási kísérletek értékelése Likavkáról. **(Evaluation of provenance trials of Scots pine established in 1909-12 near Likavka).**
Erdész. Kutat. 1958 : **5** : No. 3–4 : 68–99 : from Hungar. agric. Rev. 1959 : **8** : No. 4 : p. 8.

Data from the above trials in Hungary indicate that the greater the difference in climate between the place of origin and the planting site of the material, the lower the volume production. Trees of oceanic provenance did very badly, those of boreal origin rather better while the yields of continental trees were 80% of the standards or more. The difference between oceanic and boreal types was significant (t = 2·43), between oceanic and continental highly significant (t = 3·48) and between boreal and continental nonsignificant (t = 1·26).

3229 Langner, W.
Ergebnisse einiger Hybridisierungsversuche zwischen *Picea sitchensis* (Bong.) Carr. und *Picea Omorika* (Pančič) Purkyne. [**Results of some hybridization experiments between *P. sitchensis* (Bong.) Carr. and *P. Omorika* (Pančić) Purkyne**].
Silv. genet. 1959 : **8** : 138–43.

On the whole, very low seed sets were obtained in crosses in both directions but no conclusions may be drawn from these results for only a few parent trees were used. Two combinations gave fairly good results. In all cases the hybrid seed was of normal viability. All the progenies showed hybrid characters and some of them grew faster than the parent species but this character seems to vary with the different parental combinations. Other characters of the hybrids were intermediate between those of the parents in some crosses, this being true for susceptibility to frost. No conclusion has yet been drawn on the growth habit of the hybrids.

3230 Santamour, F. S.
Bisexual conelets in spruce.
Morris Arbor. Bull. 1959 : **10** : 10–11.

Bisexual conelets were observed on 11 trees representing 7 spruce species in the Philadelphia area in 1958. These were *Picea asperata* (2 trees), *P. balfouriana* (1), *P. glauca* (3), *P. montigena* (2), *P. retroflexa* (1), *P. smithiana* (1) and *P. wilsonii* (1). The bisexual conelets of all species except *P. smithiana* were essentially of the same type: male tissues occurred on the lower portion of the conelet while the female tissues occupied the tip in varying proportions. Although some bisexuals were erect, as is the normal female, all appeared to be basically male.

Pollen abortion was considerably higher in the bisexual than in normal male conelets. An additional abnormality of the "bisexual" pollen was noted in *P. asperata* and *P. wilsonii*, 6% and 63% respectively of whose pollen was shed in the form of tetrads. Mature cones developed from bisexual conelets only on *P. smithiana*. The three mature cones found were all derived from conelets with only a narrow collar of male tissue near the middle. "Survival and maturation of bisexual conelets apparently depends to a large extent on the amount of female tissue present." The severe drought of 1957 is suggested as a possible contributing factor to the sudden appearance of bisexual conelets in the following year.

3231 Illies, Z. M.
Weitere Mehrlingsuntersuchungen bei *Picea abies* (L.) Karst. [**Further studies of polyembryony in *P. abies* (L.) Karst.**].
Silv. genet. 1959 : **8** : 111–13.

Mother trees differing in their tendency to produce seeds with more than one embryo were open pollinated and used in controlled crosses. An investigation of the resulting progenies showed that the mother plant has considerable influence on the occurrence of polyembryony, the male parent and the environment having apparently no effect. No relationship was found between the occurrence of seedlings with abnormal chromosome numbers and the proportion of polyembryonic seeds.

3232 Taylor, T. M. C.
The taxonomic relationship between *Picea glauca* (Moench) Voss and *P. engelmannii* Parry.
Madroño, S. Francisco 1959 : **15** : 111–15.

The above species appear to represent no more than the extremes of one continuously varying population. It is proposed that they be respectively reduced to the subspecies *P. glauca* subsp. *glauca* and *P. glauca* subsp. *engelmannii*.

3233 Cook, D. B. & Nyland, R. D.
Three young plantations of hybrid larch.
J. For. 1959 : **57** : 750–51, 754.

Height distribution curves of three plantations grown at Saratoga, N.Y., are given; these are

thought to include hybrids between Japanese and European larches. Some individuals are twice as tall as the average tree after seven years' growth.

3234 Manžos, A. M. & Pozdnjakov, L. K.
(A triploid form of *Larix dahurica* from central Jakutia).
Dokl. Akad. Nauk SSSR (Proc. Acad. Sci. USSR) 1960 : **130** : 437–39. [Russian].

The above form produced 67% viable seed on self fertilizing and 69% on cross fertilizing, the set after self fertilization being regarded as remarkably high. The seed from selfing had 36 chromosomes in the root tips. The pollen grains of the triploid varied in diameter from 10 to 96μ. The germination rate of the pollen was high.

VEGETABLES

Annual Report of the Glasshouse Crops Research Institute, Littlehampton, Sussex 1958 : Pp. 94.

3235 *Darby, L. A. Plant breeding.* (*p. 46*).
Lettuce. The project previously outlined was continued [cf. 837]. R_1 plants showing sectorial changes in leaf colour were selected and R_2 seed was produced. F_1 plants from crosses of Cheshunt 5B with lighter coloured varieties were as dark green as the former variety and intermediate between the parents in hearting.
Cucumber. Breeding to improve fruit number, weight and quality continued.
Tomato. Crosses between Baby Lea, with green stems and compact habit, and purple-stemmed tall varieties have not yielded genotypes combining purple stem and compact habit. Purple stem is considered to be preferable as a seedling marker facilitating early selection for compact habit by growers. The genetics of the two characters is to be further studied.

3236 Lechner, L.
Über die Sortenleistung von Feldhülsenfrüchten auf Grund mehrjähriger Landessortenversuche in Bayern (1950–1957). **[The varietal performance of leguminous field crops on the basis of several years' provincial varietal trials in Bavaria (1950-1957)].**
Bayer. Landw. Jb. 1959 : **36** : 460–511.

A full report is presented of trials of *Vicia faba, V. sativa, Pisum sativum, P. arvense, Lupinus luteus, L. angustifolius* and *L. albus*; descriptive notes on the varieties tested are included.

3237 Uşakova [Ušakova], E. I.
Metode folosite şi realizari în selecţia culturilor de legume şi organizarea producerii seminţelor de legume în URSS. **(Methods used and results in breeding vegetable crops and the organization of vegetable seed production in the USSR).**
Grădina Via Livada 1957 : **6** : No. 12 : 65–75.

Soviet vegetable breeding methods, in particular Mičurinist techniques, are described, and some recently obtained varieties of a number of vegetable crops are listed.

3238 Bremer, A. H.
Planteforedling i norsk grønnsakdyrking. **(Plant breeding in Norwegian vegetable production).**
Gartneryrket 1956 : **46** : 586–89.

The introduction of bush tomatoes and marrowfats with the sugar-pea type of pod into Norway is described and some Norwegian varieties are mentioned. The possibility of breeding to improve caraway, which is used both as spice and as vegetable in Norway, is discussed.

3239 Bremer, A. H.
Norsk foredling av grønsakvokstrar. **(Norwegian vegetable crop breeding).**
Gartneryrket 1956 : **46** : 611–12.

The desirability of establishing a central breeding institute in Norway for the development of varieties adapted to Norwegian conditions is urged.

3240 Zelinschi, N.
Soiuri valoroase de legume pentru regiunile secetoase — Bărăgan şi Dobrogea. **(Vegetable varieties of value for the dry regions of Bărăgan and Dobrogea).**
Grădina Via Livada 1958 : **7** : No. 3 : 1–5.

As a result of trials held at Basarabi in 1951–53 and Mărculeşti in 1954–57, varieties of tomato, French bean, cabbage, cauliflower, cucumber and sweet pepper suitable for the above regions are indicated.

3241 Savinova, N., Tarpalaru, E., Lëbl [Löbl], D. & Iordakesku [Iordăchescu], O.
(Soviet-bred tomatoes and cucumbers in the Rumanian People's Republic).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 11 : 67–69. [Russian].

Cucumber. Borščagovskij 26 and Nerosimyj 40 [Rainfed 40] were distinguished by high

yields and good keeping properties; both these varieties and Uzbek 40 are regarded as valuable breeding material for keeping quality, Murom 36 for earliness and Astrahan' 136 and Margelan for drought resistance.

Tomato. Kolhoz 34 exceeded the standard variety California in yield and earliness. Mention is made of a heterotic hybrid of Aurora x Temnokrasnyj 2077 [Deep-red 2077] which was earlier and more productive than either parent and had larger fruit than Temnokrasnyj 2077.

3242 Löbl, D.
(The utilization of F_1 hybrids in vegetable culture).
Grădina Via Livada 1957 : **6** : No. 9 : 10–14.

A review of American, Bulgarian and Soviet work in this field is given, the crops covered being tomato, egg plant, red pepper, cucumber and onion.

3243 Evdokimov, M. M.
(For a quicker development and introduction of heterotic hybrids of vegetables).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 8 : 8–10. [Russian].

Breeding hybrid varieties of cucumber, tomato and sweet corn is reported at the Institute of Plant Industry (VIR) and its branches in Moldavia and Krymsk. The results of this work include four cucumber varieties, two for outdoor and two for glasshouse culture, which show heterosis for earliness and yield. All of them produce high quality fruit. The outdoor Hybrid 200, which was obtained by multiple hybridization, is superior in resistance to mosaic, bacteriosis and mildew to Vjazniki 37, the previous standard at Alma-Ata, and outyields it by 50·8%. The other outdoor cucumber Uspeh 221 [Success 221], also a multiple hybrid, has been made a standard in many districts of Russia, Moldavia and the Ukraine, where it outyields the corresponding standards by 14–56%. The new glasshouse cucumbers VIR 1 and VIR 2 were obtained respectively from direct and reciprocal crosses between Klinskij Mestnyj [Local Klin] and Leningradskij Tepličnyj [Leningrad Glasshouse]; they yield appreciably more fruits, including first fruits, than Klinskij Mestnyj.

3244 Popova, D.
(The production of vegetables in greenhouses).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 11 : 65–67. [Russian].

Brief descriptions are given of tomato, red pepper, egg plant and cucumber varieties grown under glass in Bulgaria. Most are hybrid varieties showing heterosis for earliness and yield. The red peppers include the new heterotic varieties D103 x Sivrija, D103 x Bjala Kapija [White Gate] and D103 x Kalinkov from the Bulgarian Institute of Plant Industry. These hybrids have fruits with sweet and tender flesh.

3245 Morettini, A.
Il miglioramento e la produzione delle sementi di ortaggi. **(Improvement and production of vegetable seed).**
Riv. Ortoflorofruttic. ital. 1959 : **43** : 485–90.

The author submits that not more than 25% of the vegetable seed produced in Italy comes from selected plants; 25% is imported and the other 50% is from unselected material. Some suggestions are made for improving this situation.

3246 Ušakova, E. I. & Kononkov, P. F.
(The beetroot variety Podzimnjaja 474).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 9 : 20–21. [Russian[.

Podzimnjaja 474 [Late-autumn 474] was obtained by sixfold selection of nonbolters from Bordeaux 237 in autumn sowings at Gribovo. It is tolerant of —4 or even —5° C. and produces marketable roots appreciably earlier than spring-sown varieties in the Nonchernozem Belt. The percentage of bolters, now 6–8%, is being continuously reduced by selection. It is hardy and resistant to bolting also on territories lying further to the north when sown in the spring.

3247 Miyagi, K.
(Studies on seed selection of the carrot. II. The behaviour of the principal Japanese varieties when grown for seed selection).
Engei Gakkai Zasshi/J. hort. Ass. Japan 1959 : **28** : 115–22. [Japanese].

Bolting period, flowering period, branching habit, seed yield and germinability of the seed were studied in a series of Japanese and introduced European varieties. South Japanese varieties were superior to north Japanese varieties in seed yield and germinability of the seed; they also bolted and flowered sooner. Lateral shoots were better developed in European than

in Japanese varieties in which growth is concentrated in the strong main shoot.

3248 Kobabe, G.
Natürliche Einkreuzung von Hederich (*Raphanus raphanistrum* L.) in Radies (*Raphanus sativus* var. *radicula* DC.) und das Verhalten von Knollenform und -farbe in den nachfolgenden F- und R-Generationen. [**Natural crossing of wild radish (*R. raphanistrum* L.) with cultivated radish (*R. sativus* var. *radicula* DC.) and the behaviour of tuber form and colour in the following F and BC generations**].
Z. Pflanzenz. 1959 : **42** : 1–10.

It was found that considerable hybridization may occur between cultivated radish growing in the outermost parts of a field and wild radish growing in the neighbourhood. If the wild radish plants are not removed before pollination, seed from the outer rows of the crop should be discarded. F_1 hybrids between the species were found to be fertile and the two species are thought to have homologous chromosomes. Segregation for root shape and colour was determined in F_1–F_4 and BC_1 generations. The results indicated that several genes control root shape and that both species contribute some dominant genes. Segregation data for root colour indicated that two genes are involved. Amongst the progenies, some forms with relatively large roots and firm flesh were found and attempts are being made to develop an improved radish with nonpithy roots from this cross with wild radish.

3249 Li, Š.-D. [Li, S.-T.]
(The effect of the amount of pollen applied to the stigma upon the production and quality of the seed and upon the progeny).
Izv. timirjazev. sel'skohozjajstv. Akad. (News Timirjazev agric. Acad.) 1959 : No. 6 : 224–27. [Russian].

An account of pollination of radish with different amounts of pollen at the Timirjazev Agricultural Academy is given. The following beneficial effects of pollination with a large amount of pollen were observed. The plants developed more pods; the pods contained an increased amount of seed; the progeny raised from the seed grew more vigorously; and the percentage of large marketable roots in the progeny was higher.

3250 Bachmanowa, S., Byszewski, W. & Majewski, A.
Obserwacje i badania dotyczące hodowli bulwy (*Helianthus tuberosus*). [**Observations and investigations on breeding the Jerusalem artichoke (*H. tuberosus*)**].
Hodowla Roślin Aklimatyz. Nasiennictwo 1958 : **2** : 527–47.

Figures are given showing that certain biotypes combine a high yield of green matter with a high yield of tubers; though the dry-matter content of the tubers is low in most varieties, it is higher in some than in others, the values varying from 19·5 to 30%. A correlation was established between the yield of fresh and dry matter in the tubers. Differences were observed in degree of branching, length of time the leaves remained green, nitrogen content of the tubers (0·8–3·3%), carbohydrate content (13·0–19·5%), compactness of the tuber cluster, the ease with which they are detached from the stolons, keeping capacity, frost resistance and form of tubers; also in capacity for producing alcohol, which was correlated with the percentage of reducing sugars in the dried tubers. Some biotypes were found suitable for producing coffee substitutes.
Vegetative hybrids have been obtained by grafting the sunflower on to the artichoke and these are illustrated.
It is calculated that with yields of 200 c. per ha. the artichoke would produce a larger volume of alcohol per hectare than either potatoes or sugar beet.

3251 Munger, H. M., Jones, H. A. & Davis, E. W.
Two new onion hybrids—Premier and Empire.
Fm. Res. 1959 : **25** : No. 4 : p. 14.

The above F_1 hybrids have given promising results in New York State. Premier, released cooperatively by the US Department of Agriculture and Cornell University Agricultural Experiment Station in 1957, is a cross between inbreds B2117 and B2215, respectively derived from Early Yellow Globe and Brigham Yellow Globe. Empire, released cooperatively by the USDA and Cornell and Idaho stations in 1959, has the parentage B2267 x B2215, the former inbred also being a derivative of Brigham Yellow Globe. Both varieties are high yielding, with good storage quality, Empire storing well even into April when most varieties are deteriorating. Premier matures earlier and in combination with Empire thus gives a spread in

narvest season. Empire is a much harder onion than Premier and is therefore better adapted to bulk storage.

3252 Cristea, C.
Ceapa roşie de Făgăraş şi cultura ei prin metoda ceaclama. (**Făgăraş Red onion and its cultivation by the method of direct sowing in the field**).
Grădina Via Livada 1958 : **7** : No. 4 : 9–13.
This variety is grown in Transylvania and is of uncertain origin. It produces high yields of good quality bulbs when grown by the above method.

3253 Untilă, A.
O populaţie valoroasă de ceapă "Ceaclama de Ţibucani" şi agrotehnica ei. (**The valuable onion population Ţibucani Direct-sown and its method of cultivation**).
Grădina Via Livada 1958 : **7** : No. 5 : 14–17.
A description is given of the above local population which is grown by sowing direct in the field.

3254 Calcatin, N., Panait, T., Oarză, G. & Găureanu, I.
Cîteva populaţii locale de ceapă şi usturoi cultivate în Moldova. (**Some local populations of onion and garlic cultivated in Moldavia**).
Lucrăr. şti. Inst. agron. Ion Ionescu de la Brad Iaşi 1959 : 315–23.
Seven local Moldavian onion varieties and two garlic varieties are described.

3255 Peregudt, M. F.
(**The effect of selecting onions for duration of dormancy upon keeping quality**).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 10 : 9–11. [Russian].
Premature sprouting was mainly responsible for storage loss of local Crimean varieties at Simferopol'. A study of the variety Jalta showed that it comprised four biotypes differing in respect of dormancy; the progeny of a biotype selected for a long dormant period gave an appreciable reduction in storage loss.

3256 Kulik, M. M. & Tims, E. C.
Differences in pathogenicity and pycnidial production among isolates of *Pyrenochaeta terrestris* from a single pink root infested field in Louisiana.
Plant Dis. Reptr. 1960 : **44** : 54–58.
A set of 91 mycelial isolates were divided into four groups on a basis of their pathogenicity on White Sweet Spanish onion; 18 of them produced pycnidia or pycnidium-like bodies when cultured on agar and these gave a mean disease index rating of 73·5% of infected roots. The remaining 73 isolates gave a mean rating of only 48·1%.

3257 Khoshoo, T. N. & Sharma, V. B.
Cytology of the pentaploid *Allium neapolitanum* Cyr.
Cytologia, Tokyo 1959 : **24** : 304–14.
Cytological observations on a $5x$ race of *A. neapolitanum* showed it to be a segmental allopentaploid (AAA_1A_1B).

3258 Malik, C. P. & Tandon, S. L.
Cytological behaviour of *Asparagus curillus* Ham., in relation to different environments.
Indian J. Hort. 1959 : **16** : 39–41.
The meiotic irregularities observed in *A. curillus* when grown in high-temperature regions are described.

3259 Plumier, W.
Quelques problèmes de l'amélioration de l'asperge. (**Some problems of asparagus improvement**).
Bull. Hort., Liège 1960 : **15** : 35–38.
The difficulties of distinguishing the sexes before flower formation and the use of hermaphrodite individuals for increasing the proportion of male plants are discussed.

3260 Vazart, M. B.
Biologie florale de l'asperge *Asparagus officinalis* L. (**Floral biology of asparagus, *A. officinalis* L.**)
Rev. gén. Bot. 1959 : **66** : 405–18.
In the populations examined, two types of plant occurred with equal frequency. The female plants had flowers of uniform structure in which the stamens did not complete their development; variation in fertility in these flowers appeared to be a varietal character. The so-called male plants carried entirely male flowers and also intermediate types. A few of the intermediates appeared to be truly hermaphrodite but in most cases the sexual organs

showed some degeneration, this being most marked in the female organs. Some plants produced stems with only female flowers and other stems with hermaphrodite flowers. It is thought that sex is controlled by several genes in asparagus.

3261 Ellison, J. H. & Scheer, D. F.
Yield related to brush vigor in asparagus.
Proc. Amer. Soc. hort. Sci. 1959 : **73** : 339–44.

"Brush" refers to summer stalks measured in the autumn, vigour per plant being determined in two ways: (1) number of stalks and (2) an index based on number and relative diameter of the stalks. Yielding ability of individual ♂ and ♀ plants was significantly correlated with brush vigour in the preceding year. Positive correlations were found between number of spears and number of stalks, and between spear diameter and stalk diameter. Negative correlations were detected between number of spears and stalk diameter, and between spear diameter and number of stalks. The highest total weights of spears were obtained from plants of both sexes having many large stalks. The use of brush vigour as a criterion of selecting for yielding ability would eliminate the necessity of laborious yield recording and would make it possible to select from a much larger population.

3262 Rohde, R. A.
Basis for resistance of *Asparagus officinalis* var. *altilis* L. to the stubby-root nematode *Trichodorus christiei* Allen 1957.
Diss. Abstr. 1959 : **20** : LC Card Mic 59–1923 : 21–22. (Abst.).

A toxic substance, isolated from the roots and also from the soil surrounding the roots, proved to be responsible for the resistance of *A. officinalis* var. *altilis* 'Mary Washington' to *T. christiei*.

3263 Gotoh [Goto], T.
(A digenomic triploid plant obtained by interspecific hybridization in *Brassica* and its progeny).
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 101–08. [Japanese].

By crossing *B. pekinensis* 'Chifu' (AA) with *B. oleracea* 'Nozaki summer cabbage' (CC), an F_1 plant with $2n = 28$ chromosomes (ACC) was obtained. This gave four plants on open pollination: (1) a 47-chromosome plant morphologically intermediate between *B. oleracea* and *B. napus*; (2) a 34-chromosome plant resembling the mother plant; (3) a 42-chromosome plant with waxy leaves resembling those of *B. rapa* in shape; and (4) a 25-chromosome plant resembling *B. chinensis*. On selfing the ACC plant, two offspring were obtained: (*a*) a 46-chromosome plant resembling (1) above; and (*b*) a 29-chromosome plant of cabbage type.
On crossing cabbage ♀ with the ACC plant ♂, a 20-chromosome plant most nearly resembling a cabbage was obtained. The cross ACC plant ♀ x *B. rapa* ♂ (AA) gave three turnip-like plants with 26, 29 and 44 chromosomes respectively. On crossing *B. rapa* or *B. pekinensis* ♀ with the ACC plant ♂*, 38 plants were obtained with chromosome numbers of 22–29, 35 or 45.

3264 Chatterjee, S. S. & Mukherjee, S. K.
Studies on vegetables in West Bengal. II. Seed-raising of cabbage (*Brassica oleracea* var. *capitata*).
Indian J. Hort. 1957 : **14** : 151–62.

A number of cabbage varieties were decapitated to force flowering shoots. Good seed yields were obtained by this method from the varieties Eclipse Drumhead and English Ball. In limited performance trials, locally-produced seed of Golden Acre produced heads of higher average weight than imported seed of this variety.

3265 Nieuwhof, M.
Rand in wittekool. **(Tip burn in cabbage).**
Meded. Dir. Tuinb. 1960 : **23** : 102–06.

Differences in susceptibility to tip burn were found among the varieties Roem van Enkhuizen [Enkhuizen Fame], Success and Langendijker Herfstwitte [Langendijk Autumn White], the last-mentioned being the most susceptible. Fertilizer treatment, sowing date and harvest time affect the incidence of tip burn, but it is thought that selection for resistance is possible.

3266 Winstead, N. N.
Reaction of cabbage varieties and clubroot-resistant lines to root-knot nematodes.
Plant Dis. Reptr. 1959 : **43** : 1280–81.

No correlation has been found in North Carolina between resistance to clubroot and resistance to attack by *Meloidogyne* spp. but the varieties tested were less severely affected by *M. hapla* than by other species.

* The English summary to this paper inadvertently refers to these crosses as ACC ♀ by AA ♂.

3267 Gusev, P.
(Fodder kale in the north).
Nauk. pered. Opyt sel'sk. Hozjajstv. (Sci. progr. Exp. Agric.) 1959 : No. **3** : 24–25. [Russian].
Tysjačegolovaja [Thousand-headed] outyielded Mozgovaja Zelenaja [Green Marrow-stem] and Mozgovaja Sinjaja [Blue Marrow-stem] and developed a higher proportion of leaves and tender shoots than the other two varieties in trials at Hibiny.

3268 Nieuwhof, M.
Efficiënte selectie van bloemkool in de zomer en herfst. **(Efficient selection of cauliflower in summer and autumn).**
Zaadbelangen 1960 : **14** : 21–22, 36–38.
If summer and autumn varieties are selected in summer or autumn for breeding, the seed does not ripen, while if they are grown so that they mature in spring, the selected plants set seed but are not necessarily adapted to summer or autumn cultivation. Two methods of avoiding these drawbacks are described. In the first, selection is carried out in spring, after autumn sowing, and part of the selfed seed obtained is retained and sown in spring to allow summer progeny evaluation. The remainder may be sown in the first autumn, selected again in spring and subjected later to a final selection based on the summer evaluation, or it may be held over until the following autumn and, after evaluation according to summer performance, subjected to further selection the following spring.
In the second method, the plants are selected in summer or autumn and vegetatively propagated through the winter by allowing the cauliflower stumps left after removal of the curd to continue growing until root shoots have formed, which can be removed and rooted. These cuttings are then allowed to flower, are selfed and can be further selected. The two methods may be combined.

3269 Noll, J. & Gottschling, W.
Bekämpfung der durch Molybdänmangel verursachten Herzlosigkeit an Blumenkohl. **(The control of whiptail in cauliflower caused by molybdenum deficiency).**
NachrBl. dtsch. PflSchDienst., Berl. 1959 : **13** : 169–72.
Of the 20 varieties and strains tested, Lecerf and M16/1 were the most resistant to molybdenum deficiency; other varieties were very susceptible.

3270 Johnson, A. G.
New breeding methods for Brussels sprouts.
NAAS quart. Rev. 1959 : **11** : 53–59.
At the National Vegetable Research Station, Wellesbourne, Warwick, hybridization of inbred lines has increased the marketable crop by as much as 66% compared with the outbred varieties from which the lines were derived. The varieties used were Cambridge 1, Cambridge 3 and Cambridge Special; because of its high sprout quality, an inbred line of Cambridge Special was always used as one of the lines in the crosses. Attention is now being given to the problems of hybrid seed production on a commercial scale.

3271 Ellis, J. R. & Janick, J.
The chromosomes of *Spinacia oleracea*.
Amer. J. Bot. 1960 : **47** : 210–14.
A detailed account is provided of investigations which have already been briefly reported [cf. 2025].

3272 Webb, R. E., Perry, B. A., Jones, H. A. & McLean, D. M.
A new source of resistance to spinach blight.
Phytopathology 1960 : **50** : 54–56.
A selection from PI179590, a variety introduced from Belgium, proved highly resistant to six of the seven strains of cucumber virus 1 with which it was inoculated; it was susceptible to race 6, an isolate from *Commelina nudiflora*. Crossing with the susceptible variety Bloomsdale showed that resistance is controlled by a single dominant gene.
Reaction to spinach blight at 16°, 20°, 24° and 28° C. was compared in the PI179590 selection, the resistant variety Virginia Savoy and the susceptible Bloomsdale. At 28° C. only the selection was disease free; further studies at 32° C. however showed that it was not immune, three out of twelve plants becoming severely diseased and dying within seven days at this temperature.

3273 Helm, J.
Bemerkungen zu Handzeichnungen von Mangoldsippen aus dem Jahre 1689. **(Remarks on sketches of chard strains from the year 1689).**
Kulturpflanze, Berlin 1959 : **7** : 161–67.
Illustrations of variously coloured forms of *Beta vulgaris* var. *flavescens* found in a 17th century book by Israel Volckmann and his son are discussed. The forms closely resemble the

existing variety Krauser Silber [Silver Curly], thus showing that the wide petiole characteristic of *B. vulgaris* var. *flavescens* is quite an old character. Present-day forms do not show the same variety of colour as the 17th century types.

3274 Salokangas, K.
Rapea keräsalaatti. (**Crisp cabbage lettuces**).
Koetoiminta ja Käytäntö 1959 : **16** : p. 2.

Trials of twelve varieties have shown the following to be most successful: Cornell 456, Great Lakes and Pennlake.

3275 Albu, E.
Cercetări asupra cîtorva soiuri de salată, potrivite pentru forţat în răsadniţă. (**Investigations on some lettuce varieties suitable for forcing**).
Lucrăr. şti. Inst. agron. Ion Ionescu de la Brad Iaşi 1959 : 325–34.

Comparative trials of 7 Rumanian and German varieties for the above purpose are reported.

3276 Iordăchescu, C.
Cîteva observaţii asupra comportării soiurilor de salată în condiţiile ţării noastre. (**Some observations on the behaviour of lettuce varieties under the conditions of our country**).
Grădina Via Livada 1958 : **7** : No. 2 : 52–53.

The best early, midseason and late varieties noted in trials held at the Ţigăreşti vegetable research station, Rumania, are noted.

3277 Gagnebin, F.
Un nouveau cultivar de laitue pommée: Satellite. (**A new cultivar of cabbage lettuce: Satellite**).
Rev. hort. suisse 1959 : **32** : 360–62.

Satellite is the first of a series of new varieties being developed at the Experimental Botany Station, University of Geneva. Previously known as selection 45a, it was one of 25 lines selected from the cross Cazard x Victoria. Satellite is a large, summer variety and can be sown from May to July.
The variety showed little resistance to tip burn, but it is emphasized that observations were made during the exceptionally hot summer of 1959. It is moderately resistant to viruses.

3278 Jenkins, J. M. (Jun.).
Brown rib of lettuce.
Proc. Amer. Soc. hort. Sci. 1959 : **74** : 587–90.

A discoloration of the midribs, commonly called brown or red rib, is a serious problem in commercial plantings in North Carolina. It appears to be a physiological disorder brought about by conditions of high temperature to which most varieties are not adapted. Breeding resistant varieties probably offers the most satisfactory means of controlling both brown rib and tipburn. Five lines have shown a high degree of resistance to both.

3279 Honma, S.
A method for celery hybridization.
Proc. Amer. Soc. hort. Sci. 1959 : **73** : 345–48.

The method described led to the production of a high percentage of hybrids, its accuracy being tested by using genetically marked lines. The cut umbel of the ♂ parent, placed in a flask of water, was inserted into the muslin bag enclosing the umbel of the ♀ and suitably supported. Pollen transfer was accomplished by house flies which were introduced through a plastic tube inserted in one end of the bag and closed by a cork.

3280 Honma, S.
A method for evaluating resistance to bolting in celery.
Proc. Amer. Soc. hort. Sci. 1959 : **74** : 506–13.

From investigations at the Department of Horticulture, Michigan State University, the following conclusion has been reached. "For the purpose of screening segregating populations of celery for bolting response the best procedure appears to be at least five weeks of continuous exposure to a temperature of approximately 45° F. This treatment given to seedling plants six weeks of age in flats produced over 60 per cent bolting in Golden Plume, a standard early slow-bolting variety. As progress is made toward a high degree of cold tolerance the time of exposure can be increased. Ideally the exposure given to a particular breeding line should be that which will induce bolting in all but a small percentage of the population."

3281 Burdine, H. W.
A study of magnesium deficiency chlorosis in certain varieties of green celery.
Proc. Amer. Soc. hort. Sci. 1959 : **74** : 514–25.

Certain varieties, e.g. Utah 10B, Utah 16 and Emerson Pascal, cultivated in New York State exhibit a Mg-deficiency chlorosis, even when soil tests have indicated the presence of adequate amounts of exchangeable Mg for normal growth. Pope and Munger have reported that this

chlorisis was inherited as a monogenic recessive [XXIV, 701]. On the basis of the results of the present study, it is suggested that chlorotic varieties are merely less efficient in their ability to absorb Mg, suppression of Mg absorption by K or Ca not being involved. Chlorotic varieties are also probably less efficient in their capacity to absorb nitrates.

3282 Tarbaeva, L. P.
(Melons and water melons in Novosibirsk province).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 8 : 22–23. [Russian].

A few varieties which ripen a fair proportion of their fruits in the Siberian climate are listed. The melons include Altaj, which was the earliest and the most productive among the varieties tested at the Novosibirsk Botanic Garden. Work on improvement of its flavour, earliness and yield by selection is in progress.

3283 Winstead, N. N. & Riggs, R. D.
Reaction of watermelon varieties to root-knot nematodes.
Plant. Dis. Reptr. 1959 : **43** : 909–12.

A set of 83 water-melon varieties are all susceptible to *Meloidogyne javanica, M. incognita incognita, M. incognita acrita* and *M. arenaria arenaria*. All show a high degree of resistance to *M. hapla*.

3284 Rhodes, A. M.
Species hybridization and interspecific gene transfer in the genus *Cucurbita*.
Proc. Amer. Soc. hort. Sci. 1959 : **74** : 546–51.

The use of *C. lundelliana* as a bridging species in development of multiple interspecific hybrids is being explored at the Drug and Horticultural Experiment Station, University of Illinois. Data are given on the fertility of hybrids involving, in various combinations, *C. lundellianus* with one, two or three of the species *C. moschata, C. pepo, C. mixta* and *C. maxima*. The results showed that factors for bush habit may be transferred from *C. pepo* to *C. moschata* by means of trispecific hybrids incorporating *C. lundelliana*, and that trispecific-hybrid selections may be obtained with resistance to powdery mildew (*Erysiphe cichoracearum*) derived from *C. lundelliana*. The reaction of the cotyledons may be used as a simple test of tolerance of powdery mildew. The cotyledons of tolerant plants remain green; those of susceptible seedlings dry up prematurely. The leaf type of the most mildew-tolerant plant among the *C. pepo* x (*C. lundelliana* x *C. moschata*) hybrids resembled the deeply lobed leaf of *C. lundelliana*, while the leaf type of the most mildew-tolerant plant among the (*C. lundelliana* x *C. moschata*) x (*C. mixta* x *C. moschata*) hybrids showed a closer resemblance to that of *C. moschata*. Because of the low fertility of combinations involving *C. maxima*, information on the inheritance of resistance to the squash vine borer, a character found in *C. moschata* and *C. mixta*, was meagre. Segregates differed in degree of hardness of the stems and peduncles, the more *C. maxima* - like fruits having the softer peduncles.

3285 Nakamura, N. & Maekawa, S.
(Vegetative hybrids of cucurbits. II. On variation and heritability in first generation vegetative hybrids of the cucumber).
Hyogo Noko Daigaku Kenkyu Hokoku : Nogaku Hen/Sci. Rep. Hyogo Univ. Agric. : Ser. Agric. 1958 : **3** : 87–92. [Japanese].

In continuation of researches on the F_0 generation of cucumbers grafted on various Cucurbitaceous stocks [cf. XXIX, 4573], the authors report a number of differences between the progenies of the scions of different grafts in respect of germination, growth, incidence of disease, number of flowers, flowering date, fruit yield and, most particularly, petal shape.

3286 Tibrova, M. A.
(Cucumber varieties for salting in the Ukrainian SSR).
Sad i Ogorod (Gdn. & Veg. Gdn.) 195:9 No. 10 : 14–16. [Russian].

Nežinskij Udlinennyj [Nežin Long], a selection from Černigov, was the only new variety which equalled the Ukrainian standards Nežin 12 or Nežinskij Mestnyj [Local Nežin] in salting quality. It also outyielded Nežin 12. The varieties Doneckij Zasoločnyj [Donec Salting] from Stalino, Hybrids 29 and 63/49 from Har'kov, Don 175 from Birjučij Kut and Hybrid 221, bred at Krymsk, Krasnodar territory, were mainly interesting for improved yield; some were early, produced a high percentage of marketable fruits, had improved flavour when eaten fresh or did not turn yellow as quickly as standard varieties.

3287 Myrstad, A. & Johnsen, J. K.
Sortsforsøk med veksthustomat 1955–1957. **(Varietal trials of greenhouse tomatoes, 1955-1957).**
Gartneryrket 1958 : **48** : 25–27.

The results of trials of six varieties at Gjennestad and Vea, Norway, are presented.

3288 Åkesson, H.
Tomatförsök vid Weibullsholm 1959. **(Tomato trial at Weibullsholm, 1959).**
Weibulls Allehanda 1959 : **19** : 8–9.

Data on total yield and yield of different grades of fruit are given for commercial and breeding material tested in 1959. Of the former, Immuna was best in yield, quality and earliness, while among the latter, cross 129 surpassed all the other tomatoes tested in total yield and yield of top-grade fruits and equalled the control in earliness.

3289 Johnsen, J. K. & Myrstad, A.
Sortsforsøk med veksthustomat 1957. **(Varietal trials of greenhouse tomatoes, 1957).**
Gartneryrket 1957 : **47** : 934–35.

Of eight varieties tested at eight Norwegian stations, Kvithamar F_1 and Weibull's Immuna gave the highest yields and were both free from *Cladosporium fulvum.*

3290 Weber, E.
Genetische Analysen von Merkmalen mit fluktuierender Variabilität auf mendelistischer Basis. **(Genetical analyses of characters with fluctuating variability on a Mendelian basis).**
Diss. Inst. Obstbau Gemüsebau Stuttgart-Hohenheim 1958 : Pp. 69.

The genetics of seedling size (hypocotyl, cotyledons and first leaf) was studied in the F_0–F_2 and BC_1 of the tomato cross Bonner Beste x Prof. Rudloff. A single gene difference appeared to affect this character in this cross. Dimeric segregation involving seedling size and cotyledon colour using a different strain of Prof. Rudloff is also considered. Special attention is paid to the technique of analysing genetically a character which may be represented by a frequency distribution curve.

3291 Weber, E.
The genetical analysis of characters with continuous variability on a Mendelian basis. I. Monohybrid segregation.
Genetics 1959 : **44** : 1131–39.

"A method of genetical analysis of characters with continuous variability on a Mendelian basis is described and illustrated by a simple example of the inheritance of cotyledon size in two varieties of tomato. The character concerned is specified more precisely by a number of single measurements than by one measurement only. These single measurements are combined to a total measurement by the aid of a discriminant function. The frequency distributions of the single measurements of the F_2 generation reveal no segregation whatever owing to their continuity, whereas the frequency distribution of the total measurement of the F_2 generation shows a marked notch. From this discontinuity of the frequency distribution of the total measurement of the F_2, the number of segregating collectives as well as their relative shares leading to the Mendelian segregational figures, are to be inferred." [Author's summary].

3292 Cordner, H. B. & Hedger, G.
Determinateness in the tomato in relation to variety and to application of N-meta-tolylphthalamic acid of high concentration.
Proc. Amer. Soc. hort. Sci. 1959 : **73** : 323–30.

The results suggested that higher degrees of determinateness depend upon higher concentrations of a naturally occurring growth substance. N-m-tolylphthalamic acid appeared to neutralize the influence of this hormone, thus intensifying the expression of determinateness and nullifying the action of gene *Sp* for indeterminate growth.

3293 Åkesson, H.
F_1-hybrider av tomat. **(F_1 hybrids of tomato).**
Weibulls Allehanda 1959 : **19** : 18–21.

In this summary of a lecture delivered at the Scandinavian Agricultural Research Association Congress held in Oslo in 1959, a brief survey of the history and advantages of F_1 hybrids of tomato and of some of the breeding difficulties involved is given.

3294 Williams, W.
The isolation of 'pure lines' from F_1 hybrids of tomato, and the problem of heterosis in inbreeding crop species.
J. agric. Sci. 1959 : **53** : 347–53.

The problem of the fixation of apparent heterosis in the cultivated tomato and other inbreeding crops is discussed. It is argued that heterosis, in the sense of a phenomenon due to heterozygosity, is not likely to be of general occurrence in inbreeders. Investigations have been undertaken at the John Innes Horticultural Institution, England, to determine whether maximum yield expression in the tomato is attained only in F_1 hybrids and to make an attempt at rationalizing the development of F_1 hybrids as a method of improving inbreeding crops. Two commercial F_1 hybrids, Hertford Cross (Potentate x LMR1) and Ware Cross (Potentate x ES1), were used. F_2 plants were initially selected for earliness of fruit ripening on the

basis of date of opening of the first flower on the first inflorescence, a character previously found to be positively correlated with fruiting time in these particular hybrids. As the result of subsequent selection for fruit size and quality, 32 lines from each hybrid were carried forward to the F_3, the proportion finally selected from the F_2 being about 1% of the total progeny. Selection in the F_3 and F_4 was based on fruit weight and quality during the first four weeks of production. As indicated by data on (1) flowering and ripening dates in the F_2, (2) flowering date, fruit number per plant, average fruit weight and yield per plant in the F_3 and (3) yield per plant in the F_4, three lines from each cross maintained a performance over three generations which was equal or superior to that of the F_1. The superiority of F_1 hybrids over their parents may therefore be fixed in pure-breeding lines. Discussing the practical value of F_1 hybrids, it is pointed out that such varieties may represent improvements merely because they possess suitable combinations of the components of yield [cf. 996]. The development of F_1 hybrids is only justified if reliable methods of predicting their performance are available, and even in this case only as an interim measure while pure lines are being produced. Given such methods of prediction, it would not be necessary to make a large number of exploratory crosses. In the selection of pure lines, the size of the F_2s need not run into the astronomical numbers predictable from general experiments on quantitative inheritance. Because of the effects of selection in inbreeders, the best parents may be expected to differ with respect to only a small proportion of the loci for quantitative characters. In the material investigated, desirable recombinants were isolated with a frequency of one in every 1000–1500 F_2 individuals.

3295 Vnučkova, V. A.
(Interspecific hybridization of tomatoes).
Izv. Akad. Nauk SSSR (News Acad. Sci. USSR) : Ser. Biol. 1959 : No. 3 : 438–45. [Russian].

The progeny of *Lycopersicon esculentum* x *L. hirsutum* showed great variability at Gorki Leninskie and the variability increased with each successive generation. The hybrid gave rise to plants which either resembled *L. esculentum*, combined the morphological characteristics of the parental species, or differed from both in habit or leaf and fruit characters. All plants of the cultivated type were normally fertile while hybrid types showed varied degrees of sterility. As the hybrid progenies continued segregating, the number of plants of pure parental type increased, and with the loss of the morphological characteristics of the other parent, their fertility was restored.

3296 Rick, C. M.
Hybridization between *Lycopersicon esculentum* and *Solanum pennellii*: phylogenetic and cytogenetic significance.
Proc. nat. Acad. Sci. USA 1960 : **46** : 78–82.

The single collection of *S. pennellii* ($2n = 24$) proved to be self fertile. Crosses of *L. esculentum* ($2n = 24$) ♀ x *S. pennellii* ♂ set fruit with a variable number of seeds, hybrids ($2n = 24$) being raised without any special difficulties. The reciprocal cross failed. The F_1 hybrids were intermediate with respect to nearly half of some 30 morphological differences between the two parents. In the case of about one fifth of the characters, the tomato was dominant. For the remainder, *S. pennellii* showed dominance. Despite their heteromorphy, the chromosomes of the two parents paired, the only deviations from normal meiosis being a quadrivalent or secondary association between two bivalents in 20% of the diacinetic figures and lagging univalents in 5% of the metaphase and anaphase figures. The hybrids had 75% stainable pollen, their seed yields upon selfing being 30% of the parental production. About 40% of the seeds germinated. The net reproductive fertility, as measured by number of F_2 plants produced through selfing, was 12% of the normal. Colchicine-induced tetraploids of the F_1 hybrids formed multivalents but with a lower frequency than autotetraploid tomato. Chromosome doubling led to a considerable increase in seed yield, an observation which implies appreciable chromosomal differentiation between the parents. The anomalous genetic affinity between the parents casts doubt on the taxonomic validity of the genus *Lycopersicon*. The discovery of their compatibility opens up a large field of inquiry into compatibility relations, introgression and tomato breeding and genetics.

3297 Stubbe, H.
Mutanten der Kulturtomate *Lycopersicon esculentum* Miller III. **(Mutants of the cultivated tomato *L. esculentum* Miller. III).**
Kulturpflanze, Berlin 1959 : **7** : 82–112.

Fifty more mutants of Lukullus, Condine Red

and Rheinlands Ruhm [Rhineland Fame] are described [cf. XXIX, 3228]. These are: *accumbens*, forming cylindrical bushes ⅔ normal size, the leaves and leaflets having short stalks; *adpressa*, showing some reduction in growth and weak development of side shoots and a creeping habit in late development; *applanata*, with a widely spreading and loose habit, elongated leaves and flat wide fruits; *bipinnata*, also with spreading habit and elongated greyish-green leaves, the leaflets being deeply divided and the fruit ripening early; *complicata*, reaching ⅓ normal height with upright growth and slight branching, the leaves being somewhat thicker than normal and the leaflets keeled; *conversa*, rather smaller than normal forms with a more compact habit and lighter leaf colour; *coriacea*, ¼–⅓ normal size forming an irregular spindle-like bush; *crispa*, very small and semilethal with light olive-green leaves covered with net-like necroses, the flowers and fruits being only produced after grafting on to a normal stock; *curvifolia*, showing some reduction in growth, the shoots being slightly curved and the leaves also curving downwards; *decumbens*, of normal size and prostrate habit; *detrimentosa*, ⅔ normal size with weak development of side shoots, loose habit and the leaves tinged with yellow; *divaricata*, showing slight reduction in growth, the yellow-tinged leaves being violet on the under side and growing obliquely upwards with the leaflets keeled; *fertilis*, with almost normal growth, light green leaves, and extra large primary flowers in the first inflorescence; *flacca*, ⅔ normal size, shoots thin and pendulous leaves tinged with yellow; *frugalis*, smaller than normal plants and forming a hemispherical bush, the internodes being more reduced than the leaves; *glauca* with slight reduction in growth, the formation of lateral shoots being somewhat inhibited, the leaflets keeled and glossy; *glaucophylla*, slightly reduced in size with yellowish light-green or slightly greyish green leaves; *globularis*, forming a spherical bush with yellowish leaves and boat-shaped leaflets; *griseifolia*; small with leaf colour varying during development from light yellowish-green to a light greyish-green; *heteroidea*, small with a loose habit of growth and rather narrow, slightly-keeled leaflets which become brittle with age; *impedita*^{distincta}, ¼ normal size, compact in habit, the keeled leaflets having yellow margins; *impedita*^{exigua}, ⅓ normal size and similar to *impedita*^{distincta}; *inclinata*, with some reduction in size, a bushy loose habit, the main shoot irregularly curved and the leaves tinged with yellow; *indehiscens*, almost normal in size and habit with large leaflets and the sepals mostly fused; *laesa*, ⅓–⅔ normal size, irregularly bushy and showing whitish brown necroses and dark streaks on axillary buds, shoots and leaf axils at the end of the growing period; *luteola*, normal development, bright yellow flowers; *macrocarpa*, with a wide loose habit of growth and large fruit; *marcescens*, ⅔–¾ normal size with dark green leaflets, tending to wither even under favourable conditions of soil and humidity and delayed flowering; *multifolia*, with elongated grey-green leaves and many stipules often resembling leaves in form; *multinervis*, with internodes and leaflets somewhat shortened and matt light-green leaves, the venation being normal in colour and finer than in normal leaves; *obscura*, about ½ normal size with a reduction in side-shoot development; *ochroleuca*, with greyish-green leaves having at first whitish and later yellowish-green flecks; *olivacea*, small, with the leaves reduced more than the internodes, the irregular leaflets with olive-green patches or faded in colour; *pendens*, somewhat reduced in size, sturdy leaves with the leaflets tending to hang downwards; *plana*, ¾ normal size, the leaflets being slightly bent upwards and yellowish or light green; *plicata*, slightly reduced in size with narrow leaflets bent upwards and resembling boats, tinged with yellow and flowering delayed; *polylopha*, rather compact in growth with shortened internodes and leaves, the main shoot often showing fasciation and the primary flowers being mostly extra large; *procumbens*, ¾ normal size, the shoots becoming prostrate during fruit development; *rigida* showing some reduction in size, the young plants being rigid and upright and becoming almost normal later, leaves yellowish to light-green; *rotundifolia*, ¾ normal size, the internodes being more reduced than the leaves, which are firm, rounded at the sides and blistered on the upper surface; *semiglobosa*, reaching about ⅓ normal size and forming an irregular hemispherical bush; *sinuata*, small with the internodes more reduced than the leaves, the margins of the yellowish leaflets being sometimes turned upwards and curved; *sparsa*, with some reduction in growth depending on the environment, leaflets relatively large and yellowish light-green whilst young, later becoming normal; *sphaerica*, ¼ normal size and spherical in habit with thick leaves which are light in colour when young; *sterilis*, about ½ normal size, each leaf having many small leaflets and blistered intercostal areas, the flower buds tending to die prematurely and fruit set being very low; *succedanea*, reaching between ½ and ⅓

normal size, upright with few branches, the leaves being more reduced than the internodes, the leaves rather thick and the old leaves turning yellow early; *suffusa*, slightly reduced in size with a rather broad loose habit and yellow-tinged leaves; *tarda*, ⅓ normal size with thick, leathery, shiny leaves and delayed flowering and fruit set; *torosa*, irregular in growth form with some reduction in side shoot development, all parts being somewhat thicker than normal, the leaves on the inhibited shoots being rolled, knot-like thickenings often occurring under the sepals; and *truncata*, about ½ normal size with few branches and leaves more reduced than the internodes and turning yellow early, flowering delayed.

As regards mutants mentioned in earlier papers of this series, *bracteata* is said to be identical with *aurea* described by Lesley, *robusta*^{immuna} is identical with dwarf of Young and MacArthur and *tricuspis* corresponds to trifoliate of Robinson and Rick.

3298 Verkerk, K.
Neutronic mutations in tomatoes.
Euphytica, Wageningen 1959 : **8** : 216–22.

From 450 seeds of Ailsa Craig irradiated for 4 hr. at 5·1 x 10^8n/cm.^{2}/sec., pile level 0·5 kW., 50 progenies with 43 recessive mutants were obtained, one of the progenies having three mutants and eight having two mutants each. Many of the mutants are recognizable during the first four weeks of growth and may thus be of use in genetical studies. Fourteen of the mutants showed varying degrees of sterility and fifteen displayed abnormalities of leaf colour.

3299 Endlich, J.
Genetische und cytologische Analyse einer dominant wirkenden, im Dominanzgrad verschiebbaren Mutation bei *Lycopersicon esculentum* Miller. **(Genetical and cytological analysis of a dominantly acting mutation variable in the degree of dominance in *L. esculentum* Miller).**
Kulturpflanze, Berlin 1959 : **7** : 131–60.

The mutation designated *subsistens* (*Sus*) was discovered in X-irradiated plants of the variety Rheinlands Ruhm [Rhineland Fame]. A single dominant gene is involved; the development of the heterozygote is inhibited and the homozygous condition is lethal with 100% penetrance. The homozygous plants die at various stages of development, this being influenced by conditions of temperature and illumination. When *Sus*/*Sus* plants were grafted on to normal rootstocks of Rheinlands Ruhm, they developed normally but the progeny of such grafts were 100% lethal on their own roots. Heterozygotes showed phenotypes ranging between very poor development to almost normal development; the phenotypes were classified into five classes. The degree of dominance of the *Sus* gene was greatly influenced by environmental conditions. Raised temperature and weak illumination reduced the dominance. Amongst progenies of heterozygous plants showing the second level of dominance, 0·79% of the plants were found to be tetraploid. Meiotic abnormalities were observed in heterozygous plants and this depended on the degree of dominance; the class with the highest level of dominance showed pycnotic degeneration, the next class had disturbances in the spindle mechanism and the third showed stickiness. Meiosis was quite normal in the other two classes and in homozygous individuals grafted on to ordinary plants. The different levels of dominance are thought to be related to quantitative differences of a metabolic nature.

3300 Döbel, P.
Untersuchungen zur Morphologie der Chloroplasten von Tomatenmutanten. **(Investigations on the morphology of the chloroplasts of tomato mutants).**
Kulturpflanze, Berlin 1959 : **7** : 168–83.

The abnormal chloroplasts of mutants *imbecilla*, *venosa*, *bracteata*, *fulgens* and 1770/58 arise from young chloroplasts of normal form and the degeneration process is similar in all cases. In *marmorata* and *debilis*, the abnormal chloroplasts do not undergo normal differentiation. In all mutants except *debilis*, the abnormality is inherited in a Mendelian way, the genes concerned being greatly influenced by the environment except in the case of *marmorata*. Most mutants have transitional cells containing both abnormal chloroplasts and some still unchanged normal ones; *debilis* has cells containing abnormal chloroplasts and unchanging normal ones and other cells with only one type of chloroplast. In this case some extranuclear factor may be responsible for the abnormality. All mutants with the exception of 1770/58 have been described elsewhere [cf. XXVIII, 2349 and XXIX, 3228]; 1770/58 is a small irregular bush with light green foliage.

3301 **New tomato for mid-West.**
Crops & Soils 1960 : **12** : No. 4 : p. 18.

The variety Tecumseh developed by Purdue University [cf. XXX, 873] is resistant to *Fusarium* wilt and gray leaf spot.

3302 Maliani, C.
Il pomodoro "Gimar" idoneo anche per "pelati". (**The tomato Gimar suitable also for peeling**).
Ital. agric. 1960 : **97** : 232–34.

The tomato Gimar, which is described and illustrated, was produced at the Plant Genetics Institute, Piacenza, from crosses involving both *Lycopersicon pimpinellifolium* and *L. peruvianum*. It is unusually resistant to diseases such as *Peronospora, Alternaria, Septoria* and *Cladosporium* and has firm flesh resistant to damage by hail and by transport, with good flavour, a high content of reducing sugars and low acidity. It is suitable for fresh consumption, for peeling and for sauce. Its yield has varied from 500 to 778 c. per ha., compared with the mean yield of 350 c. for the Piacenza area of Italy.

3303 Gottschalk, W.
Morphologische und cytologische Untersuchungen an experimentell erzeugten hochpolyploiden Pflanzen. (**Morphological and cytological investigations on experimentally produced high polyploid plants**).
Cytologia, Tokyo 1959 : **24** : 181–97.

Seeds of tetraploid plants of the tomato variety Immun were germinated on agar containing colchicine and six octoploids and two other high polyploids were obtained. One plant is thought to have had a 16*n* main shoot and 8*n* lateral shoots. The high polyploids had very crinkled brittle leaves of an intense green colour and produced many flowers which did not usually differ greatly from tetraploid flowers but the style was in some cases very short and the stigma only slightly indicated or lacking. No fruits were produced. The size of the stomata and also the size of the stem glands were directly related to the degree of ploidy. Hexavalents and octovalents were observed in pachytene and in addition to partner-exchange configurations some secondary pairing was noted. Other irregularities including spindle abnormalities occurred in later stages of meiosis and many gones were formed from each PMC. But in some of the anthers, meiosis was normal.

3304 Peirce, L. C. & Currence, T. M.
The efficiency of selecting for earliness, yield, and fruit size in a tomato cross.
Proc. Amer. Soc. hort. Sci. 1959 : **73** : 294–304.

A detailed account is provided of the results of investigations already briefly reported elsewhere [XXIX, 4595].

3305 Ajzenštat, Ja. S.
(**The role of supplementary fertilization with foreign pollen in hybridization**).
Ž. obšč. Biol. (J. gen. Biol.), Moskva 1959 : **20** : 115–27. [Russian].

A review of experiments on supplementary pollination, including the writer's own researches during 1949–1957 with tomatoes and peas fertilized by self pollen and foreign pollen, is presented. The foreign pollen used in the experiments with tomatoes was provided by mixed pollen of (1) red pepper + egg plant + *Physalis* + a wild potato species or (2) *Nicotiana tabacum* + *N. rustica* + potato + nightshade, and in experiments with peas by mixed pollen of vetch + lupin + lucerne + other leguminous plants. It was found that the fertilization of tomato and pea flowers was promoted by the addition of foreign pollen, when small amounts of self pollen were used or the self pollen had reduced viability as in the case of old plants. However, supplementary pollination of plants fertilized with a large amount of highly viable self pollen affected fertilization adversely or produced no noticeable effect.

3306 Doolittle, S. P. & Crossan, D. F.
Strains of *Xanthomonas vesicatoria* (Doidge) Dowson differing in virulence on tomato and pepper.
Plant Dis. Reptr. 1959 : **43** : p. 1153.

In studies in the USA, isolate 6–1 from tomato was found to produce few symptoms when inoculated into pepper and conversely isolate 58–1–r from pepper produced few lesions on tomato.

3307 Mohr, H. C. & Watkins, G. M.
The nature of resistance to southern blight in tomato and the influence of nutrition on its expression.
Proc. Amer. Soc. hort. Sci. 1959 : **74** : 484–93.

The nature of the resistance of accession T–514 of *Lycopersicon pimpinellifolium* to *Sclerotium* (*Pellicularia*) *rolfsii* proved to be anatomical. Cross sections of the basal portion of the stem of susceptible *L. esculentum* had an incomplete and irregular phellogen with little cork, whereas those of T–514 showed a complete phellogen which had produced substantial amounts of cork. When plants of T–514 were wounded superficially at the base of the stem so that the cork was scraped away, they were as susceptible as those of *L. esculentum*. Resistance was not however expressed in the seedling stage. High Ca content of the soil increased

resistance in both T–514 and *L. esculentum.* Preliminary work has indicated that the inheritance of the resistance of T–514 is complex.

3308 Abe, Y. & Gotoh [Goto], K.
Biochemical and genetical studies on anthocyanins in eggplant.
Shokubutsugaku Zasshi/Bot. Mag., Tokyo 1959 : **72** : 432–37.

The results of these investigations, which were mainly concerned with Burma and Black Beauty, have already appeared in a summarized form [cf. XXVIII, 3879]. Paper-chromatographic analysis of additional varieties showed that Sendainaga 1 [Sendai Long 1], Shinkuro [Deep Black], Hetamurasaki [Purple Stalk] and Emerald contain the same acylated anthocyanin as Burma.

3309 Rai, U. K.
Cytogenetic studies in *Solanum melongena* L. II. Chiasmata frequency.
Cytologia, Tokyo 1959 : **24** : 272–83.

The chiasma frequency and terminalization coefficient were determined in several varieties and one F_1 cross (Purple Long x White Bunchy). Chiasma frequency ranged from 2·09 to 2·45 at early diplotene and from 0·77 to 1·37 at metaphase I. The corresponding figures for the terminalization coefficient were 0·08–0·31 and 0·63–1·16. Chiasmata were observed to be localized in achromatic as well as chromatic regions. The chiasma frequency bore a close relationship with number of medianly constricted chromosomes.

3310 **Varieties of field beans.**
Frmrs'. Leafl. nat. Inst. agric. Bot. 1960 : No. 15 : unpaginated.

Brief notes are provided on the performance of British and continental varieties and stocks of winter and spring field broad beans, as observed in trials carried out by the National Institute of Agricultural Botany, England.

3311 Veldbonen, 1960. (**Field broad beans, 1960**).
Landbouwvoorlichting 1960 : **17** : Bijl. 62; Ber. Rassenkeuze : No. 279 : unpaginated.

Descriptive notes and a yield table are presented for seven varieties tested on different soil types in the Netherlands.

3312 Greenwood, H. N.
Investigations into field beans at the National Institute of Agricultural Botany.
J. R. agric. Soc. 1959 : **120** : 70–77.

A report is given on the main results of variety trials and other experiments on *Vicia faba* carried out during 1951–56 by the National Institute of Agricultural Botany with the financial assistance of the Royal Agricultural Society of England. It is concluded that a variety which would materially raise the level of productivity in Britain probably does not exist at present. Attention is drawn to the possibilities of improving the crop in several respects by different methods of breeding.

3313 Drayner, J. M.
Self- and cross-fertility in field beans (*Vicia faba* Linn.).
J. agric. Sci. 1959 : **53** : 387–403.

"1. Controlled self- and cross-pollinations were performed on field bean plants at the Plant Breeding Institute, Cambridge, England. It was found that while manipulation of the flower stimulated seed setting, both self- and cross-pollination were equally effective.

"2. Estimations of pollen germination on artificial medium, to which had been added extracts of styles or ovaries from the same or a different plant, gave some slight evidence of a specific inhibition by 'self' extracts. No analogous effect was detected on pollen tube growth.

"3. Experiments in which the style was cut at varying intervals after pollination detected no difference between self- and foreign pollen in rate of growth through the style. Pollen placed on stigmas in immature flowers began growth at once although the fertility achieved was less than when mature flowers were used.

"4. The composition of seed from mixed self- and cross-pollination was examined. Early application of foreign pollen increased the proportion of cross-fertilization but the results were similar in hybrids and inbreds.

"5. Flower manipulation was more effective in stimulating seed setting than shaking the plants. Spraying with hormone solution was ineffective.

"6. It was found that plants varied in their capacity to set seed without flower manipulation (autofertility). Hybrid plants were more autofertile than plants from inbred lines.

"7. X-ray pictures of unopened flowers suggested that the pollen may be more abundant and less diffuse in hybrids than in inbreds.

"8. The expression of autofertility was affected by many genetic factors.

"9. Seed produced by open pollination of F_1 hybrids contained a much higher proportion derived from self-pollination than did seed from inbred plants grown in the same plot. Possible explanations for this difference, and some consequences for the population genetics of the species, are discussed." [Author's summary].

3314 Landbouwstambonen, 1960. (**Field French beans, 1960**).
Landbouwvoorlichting 1960 : **17** : Bijl. 63; Ber. Rassenkeuze : No. 280 : unpaginated.
Thirteen varieties have been tested in the Netherlands. Yield data and descriptive notes are given.

3315 Pop, E.
Rezultate preliminare cu privire la productivitatea unor soiuri şi linii de fasole. (**Preliminary results on the productivity of some varieties and lines of French bean**).
Stud. Cercet. Agron., Cluj 1958 : **9** : 201–06.
Trials of Rumanian and introduced varieties during 1956–57 are reported, data being provided on yield, vegetative period and quality. The best varieties were the Rumanian selections ICAR2 and Iaşi una [Iaşi One].

3316 Nicolau, A. & Dornescu, A.
Comportarea unor soiuri de fasole de grădină cultivate pentru boabe la Staţiunea Experimentală Tg. Frumos. (**Behaviour of some garden French beans grown for the bean at the Tîrgu Frumos Experimental Station**).
Stud. Cercet. şti., Biol. Şti. agric. Iaşi 1958 : **9** : 151–56.
In this trial of Rumanian and introduced varieties, none approached the local Fasole de Banat [Banat French bean] in yield under the conditions of the test.

3317 Pavel, I. G.
Rezultatele obiţnute în culturi comparative cu soiuri şi linii noi de fasole pentru boabe. (**Results obtained in comparative trials of new varieties and lines of French bean**).
Stud. Cercet. şti., Biol. Şti. agric. Iaşi 1958 : **9** : 363–73.
Trials of 10 Rumanian and introduced varieties during 1955–57 are reported, data being provided on yield and composition of the seeds. The best variety was Iaşi una [Iaşi One], a selection from a local land race.

3318 Felecan, V. & Pop, E.
Soiuri valoroase de fasole. (**French bean varieties of value**).
Probl. Agric., Bucureşti 1958 : **10** : No. 8 : 42–46.
Varietal trials of French beans grown for pod or grain at Cluj are reported. Data are provided on yield, vegetative period, colour of seed and disease resistance.

3319 Honma, S. & Heeckt, O.
Interspecific hybrid between *Phaseolus vulgaris* and *P. lunatus*.
J. Hered. 1959 : **50** : 233–37.
Hybridization between *Ph. vulgaris* and *Ph. lunatus* failed when pure strains were used. Using heterozygous parents, ten hybrids were obtained with *Ph. vulgaris* as ♀. Reciprocal crosses failed altogether. Eight hybrids resembled *Ph. vulgaris*, their self fertility ranging from low to normal. The remaining two were of the sterile willow-leaf type. Back crosses to both parents were effected, being more successful with *Ph. vulgaris*. The F_2 and F_3 segregated for leaf type and seed and pod shape, no parental types being recovered. These characters appeared to be polygenic.

3320 Das Buschbohnensortiment. (**The dwarf bean collection**).
Samenfachmann 1959 : Nos. 19–20 : 145–60.
Descriptive notes are provided on 31 varieties with green pods, 13 varieties with yellow pods and five varieties which are suitable for drying; this collection is being grown in Western Germany.

3321 Weber-Dahlmann, M.
Ein Beitrag zur Sortendiagnose von *Phaseolus vulgaris* L. (var. *nanus* Mart.). [**A contribution to varietal diagnosis of *Ph. vulgaris* L. (var. *nanus* Mart.)**].
Saatgutwirtschaft 1960 : **12** : 10–13.
Seedlings of some varieties with pure white seeds and of others with brown seeds were grown under uniform conditions and it was found that the varieties could be distinguished by the shape and venation of the first leaves, when the seedlings were about 10 days old.

3322 Tasaki, J.
(**Studies on soil-water content and the growth and yield of *Phaseolus angularis*. II. Varietal differences in growth and yield as affected by subterranean water level**).
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1959 : **28** : 74–76. [Japanese].
Four varieties differing in maturation period were compared over a series of water-table levels. In general, the higher the water level, the better the growth, this effect being more pronounced in early than in late varieties. The highest water table (10 cm.) was, however, detrimental.

3323 Epps, J. M. & Chambers, A. Y.
Mung bean (*Phaseolus aureus*), a host of the soybean cyst nematode (*Heterodera glycines*).
Plant Dis. Reptr. 1959 : **43** : 981–82.

While the varieties Oklahoma 12 and Kiloga proved very susceptible to *Heterodera glycines*, the Jumbo type also tested was found free of white female nematodes.

3324 Dean, L. L. & Wilson, V. E.
A new strain of common bean mosaic in Idaho.
Plant Dis. Reptr. 1959 : **43** : 1108–10.

A new strain of bean virus causing similar symptoms to those of bean virus 1 was found in 1954 on the resistant variety Great Northern 41–123. The reaction of 19 bean varieties was tested and all those carrying recessive resistance to bean virus 1 were susceptible to the new strain; those carrying dominant resistance to bean virus 1 were in part susceptible. Varieties resistant to the new strain are: Idaho Refugee, Idaho Bountiful and Topcrop.

3325 Thomason, I. J. & McKinney, H. E.
Reaction of cowpeas, *Vigna sinensis*, to root-knot nematodes, *Meloidogyne* spp.
Plant Dis. Reptr. 1960 : **44** : 51–53.

The following lines and varieties of cowpea are resistant to *M. incognita acrita*: PI121,433; PI152,199; PI164,337; 21–2; Browneye 7; Chinese Red; Chino 2; Groit; Iron 9–1; New Era; and Suwanne. All lines tested were moderately susceptible to *M. javanica*, though there is some indication of resistance in the breeding line M775.

3326 Oprișor, N., Dumitrescu, O. & Busuioc, G.
Comportarea cîtorva soiuri de soia în anul 1955 și rezultatele culturilor comparative pe anii 1956–1957. (**Behaviour of some soya-bean varieties in the year 1955 and the results of comparative trials in the years 1956-57**).
Lucrăr. și ti. Inst. agron. Ion Ionescu de la Brad Iași 1959 : 145–51.

Trials of Soviet and Rumanian varieties and of some lines selected from them are reported, information being given on yield, 1000-grain weight and fat content.

3327 Sapin, P.
Le soja dans le monde. (**The soya bean in the world**).
Bull. agric. Congo belge 1959 : **50** : 897–948.

The marked shortening of the vegetative cycle which occurs when imported varieties are grown under equatorial photoperiodic conditions has limited the use of such varieties in breeding programmes at Yangambi. However, the relatively high rate of natural hybridization among local varieties has made possible the selection of some high-yielding bean and forage varieties from plants already adapted to local conditions.

3328 Swen, M. S. D. [Sun, H.-T.] & Keng, C.-H.
(The classification of soya-bean varieties).
Chih-wu-fen-lei-hsiao Pao (J. Pl. Taxon.)/ Act. phytotaxon. sin. 1952 : **2** : 1–19. [Chinese].

A botanical classification of 78 Chinese varieties is presented, based, in the first instance, on testa colour.

3329 Dimmock, F.
Note on Merit soybean.
Canad. J. Pl. Sci. 1960 : **40** : 207–08.

Further information is provided on Merit, recently licensed in Canada [XXIX, 4638]. In addition to being early in maturity, with high yield and high oil content, it has resistance to *Phytophthora* root rot and seed-coat mottling.

3330 Nagata, T.
Studies on the differentiation of soybeans in the world, with special regard to that in southeast Asia. 2. Origin of culture and paths of dissemination of soybeans, as considered by the distributions of their summer vs. autumn soybean habit and plant habit.
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1959 : **28** : 79–82.

Four ecotypes are defined: (1) *manchuriensis*, with long growing and flowering periods and an indeterminate bush habit, occurring in Manchuria; (2) *japonicus borealis*, with a long growing period, short flowering period and determinate bush habit, occurring in northern Japan; (3) *japonicus australis*, with short growing and flowering periods and determinate bush habit, occurring in southern Japan and the islands to the south; and (4) *indo-chinensis*, with an indeterminate climbing habit, occurring in south-east Asia and Indonesia. These ecotypes represent the differentiated end points of lines of migration which appear to diverge from a centre of origin in northern China. Soya beans are believed to have reached Japan both directly from China and via Korea. Three routes are envisaged for the migration of soya beans to south-east Asia and India: (1) the coast route

from southern China to Indochina; (2) Yunnan to Burma; and (3) via the Silk Road to Sinkiang and thence to Kashmir. [Cf. XXI, 1446].

3331 Fukui, J. & Goto, T.
(Varietal differences in the effects of day length and temperature on the development of the seed in the soya bean).
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **9** : 219–26. [Japanese].

A comparative study of three varieties showed that short photoperiods curtailed maturation period, this effect being positively associated with the normal length of the maturation period. Rate of seed and pod growth was also increased by short photoperiods, these effects being similarly greater in the case of longer maturation period. In general, high temperature caused a less marked acceleration in development.

3332 Grabe, D. F. & Dunleavy, J.
Physiologic specialization in *Peronospora manshurica*.
Phytopathology 1959 : **49** : 791–93.

Following the isolation of two new strains of *P. manshurica*, races 7 and 8, a set of fourteen differential soya-bean varieties is proposed for the identification of physiological races of this fungus.

3333 Ichinohe, M.
Studies on the soybean cyst nematode *Heterodera glycines* and its injury to soybean plants in Japan.
Plant Dis. Reptr. 1959 : Suppl. 260 : 239–48.

Four varieties of soya bean resistant to *H. glycines* are known: Daiichihienuki, Nangun-takedate, Gedenshirazu and Tanryoku. All these however ripen too late to give good yields, and the seed quality is often inferior. Gedenshirazu is the most promising variety and attempts are being made to shorten its growth period.

A comparative study of nematode infection and subsequent development of resistant and susceptible varieties has been made. The following features seem to be associated with resistance: failure of the majority of larvae to survive after entering, greater activity of root nodule bacteria, and greater growth of the root system.

3334 Gates, C. E., Weber, C. R. & Horner, T. W.
A linkage study of quantitative characters in a soybean cross.
Agron. J. 1960 : **52** : 45–49.

"A general procedure utilizing genetic variances and covariances for detection and estimation of linkage of the many genes controlling a quantitative character and applicable to material selfed to any arbitrary generation is presented." In the F_2 to F_7 generations derived from the cross Adams x Hawkeye, linkage was found to be significant for flowering time, height and yield but not for maturity, time of flowering to maturity, seed weight, oil percentage or lodging. Repulsion linkages predominated for height and yield while coupling linkages predominated for flowering time.

3335 Ronde groene erwten, 1960. **(Blue peas, 1960).**
Landbouwvoorlichting 1960 : **17** : Bijl. 59; Ber. Rassenkeuze : No. 276 : Pp. 3.

Data on the relative yields of 11 varieties tested on various soil types in the Netherlands are presented, together with notes on the performance of each variety.

3336 Schokkers, 1960. **(Marrowfat peas, 1960).**
Landbouwvoorlichting 1960 : **17** : Bijl. 60; Ber. Rassenkeuze : No. 277 : unpaginated.

Trial data on Big Ben, Emigrant and Zelka are presented.

3337 Kapucijners en rozijnerwten, 1960. **(Dun peas and maple peas, 1960).**
Landbouwvoorlichting 1960 : **17** : Bijl. 61; Ber. Rassenkeuze : No. 278 : unpaginated.

An account of the performance of two dun peas and four maple peas on different soil types is given in the form of notes and a comparative yield table.

3338 Wellensiek, S. J.
Neutronic mutations in peas.
Euphytica, Wageningen 1959 : **8** : 209–15.

Among 42 N_2 lines obtained after irradiation of the variety Dominant at 5·1 x 10^8n/cm.^{2}/sec. for ½, 1 or 2 hr., with a pile level of 0·5 kW., the following mutant types were observed: (1) bushy, with several short, small-leaved branches arising from the base of the plant; (2) emerald, lacking the waxy coating on stems and leaves; (3) *chlorina*; (4) dwarf; (5) spoon-leaf, in which (*a*) the stipules, borne only at the sixth or seventh node and above, are narrowly elliptical and petiolate and (*b*) the pistil and stamens are not covered by the keel; (6) colourless leaf axil; and (7) early, flowering 12 days earlier than the parent material and at the 10th node instead of the 16th. Two further mutants appeared in the N_3 for the first time and are believed to result from mutation of mutagenic genes. These are (1) a further *chlorina* mutant and (2)

an acacia type without leaf tendrils. Studies of further generations suggested that the N_2 mutant characters (3), (4), (5) and (6) and the N_3 mutants are all monogenic and recessive. It is noted that the spoon-leaf mutation occurred more than once and that in three cases two mutations occurred in one seed.

3339 Gelin, O.
Weibulls original Marma foderärt. (**The Weibull original field pea Marma**).
Weibulls Årsb. Växtföräd. Växtodling 1960 : **55** : 13–15.

Developed from a cross of Marmor [Marble] with Parvus, the marbled variety Marma yields 9% more seed than Parvus and resembles the latter in 1000-seed weight but is five days later in ripening. It also gives high yields of green fodder.

3340 **(The pea variety Pobeditel' 2-33).**
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 8 : p. 25. [Russian].

Pobeditel' 2–33 [Conqueror 2–33] was bred at Gribovo. It is a midseason marrow-fat with a high yield. The seeds have a sugar content of 5–8% and good flavour when eaten fresh, cooked, frozen or tinned.

3341 Lichter, R.
Über die Vererbung des Längen/Breiten-Index der Laubblätter bei *Pisum sativum*. (**The inheritance of the length/breadth index of the foliage leaves in *P. sativum***).
Z. Pflanzenz. 1959 : **42** : 103–46.

It is pointed out that the procedure used is of general importance in the analysis of quantitative inheritance, this being particularly true of the measuring technique. In these experiments it was found necessary to measure two leaves at the same node on each plant in order to obtain a representative value and also on all plants the measurements had to be made at the same node; the nodes with the first and second inflorescence were preferred. An analysis of diallel crosses involving 10 parents showed that there is additive gene action for the length/breadth index and incomplete dominance; non-allelic genes have a small effect. The results were analysed by various methods which are critically discussed. Both Mather's method and that of Jinks and Hayman are not thought to be useful in breeding but a variance method of analysing diallel crosses may give valuable information.

3342 Highkin, H. R.
Effect of vernalization on heat resistance in two varieties of peas.
Plant Physiol. 1959 : **34** : 643–44.

Vernalization was found to increase heat resistance in both the heat-susceptible variety Unica and the heat-resistant variety L_5. At 26° C., untreated Unica plants produced no seed and L_5 plants produced only inviable seeds. Treated plants of both varieties produced viable seed at this temperature.

3343 Schroeder, W. T., Provvidenti, R. & McEwen, F. L.
Pea streaks naturally incited by combinations of viruses.
Plant Dis. Reptr. 1959 : **43** : 1219–26.

Pea streak occurring in New York State is due to a complex of red clover vein mosaic virus and strains of yellow bean mosaic virus. One strain of the latter, 14B, has been found to cause severe streak on varieties such as W. R. Perfection and Bonneville when present in combination with red clover vein mosaic virus. These varieties are ordinarily resistant to bean mosaic virus. A search for resistance to red clover vein mosaic virus is in progress.

3344 Azrikan ['Azrikan], M.
(Chickpeas).
Sadeh (Field)/Hassadeh 1958 : **39** : 235–36; 353–54. [Hebrew].

Trials of local and introduced varieties are reported, an Algerian introduction doing best.

3345 Patil, J. A.
Inheritance study in gram.
Curr. Sci. 1959 : **28** : p. 508.

It is reported from the Department of Agriculture, Bombay, that in crosses between the low-growing, spreading-type mutant of *Cicer arietinum* [cf. XXII, 1561] and the erect varieties Niphad 10, Niphad 30 and Niphad 31, monogenic inheritance of habit was found. The erect type was dominant.

3346 Pathak, G. N. & Sahai, J.
Type 2 and Type 3, two choice grams for central U.P.
Indian Fmg. 1960 : **9** : No. 11 : p. 26.

Type 2 (back cross of Banda x Type 87 with Type 87) and Type 3 (cross of strains 197 and 195) were developed at the Kalianpur Research Farm, where they have respectively outyielded Type 87 by 15% and 17%. Type 2 is early and Type 3 late in maturity. Both are brown seeded, with higher 1000-seed weights than Type 87.

3347 YARNELL, S. H. & HILLS, W. A.
Is parthenogensis possible in sweet corn?
Proc. Amer. Soc. hort. Sci. 1959 : **73** : 407–14.

Protected by a glassine bag under conditions at the US Southeastern Vegetable Breeding Laboratory, Charleston, SC, a single non-pollinated ear (NP) of an inbred from Wappoo (Oregon Evergreen x Iogold A) developed kernels uniform in size and containing both embryo and endosperm. The weight of the seeds was about one-fourth that of seeds produced by a pollinated sibling. Germination percentage in both the field and greenhouse was high. The several plants examined had $2n = 20$. Data on segregation for plant colour in the NP_2 generation and on relative vigour (plant height) of the NP_1, a selfed sibling and the progeny and outcrosses of plants from NP kernels supported the view that a high proportion of the NP kernels had originated parthenogenetically and the remainder from fertilization through accidental crossing. The literature is examined with reference to evidence favourable and unfavourable to the possibility of parthenogenesis in *Zea mays*. On the basis of their observations, the authors suggest that slight parthenocarpic development of the caryopsis may take place in the complete absence of pollination and that even where one or a few grains develop after fertilization the slight development of the kernels outside the immediate vicinity of the fertilized kernel may not result from pollen influence. They further suggest that, in general, parthenogenesis may occur in a portion of the kernels of an ear under unusual circumstances, while the remainder result from fertilization. These circumstances may occur late in the flowering season, when only a limited amount of pollen is available during a period of high maximum temperatures.

3348 KRAMER, A.
Rapid measurement of quality of sweet corn for processing.
Proc. Amer. Soc. hort. Sci. 1959 : **74** : 472–76.

Preliminary results from ten varieties suggested that use of a shear press equipped with either (1) a shear cell and recording attachment or (2) a compression cell may offer a means of measuring toughness and succulence, respectively, and may replace the pericarp and kernel-size tests. The method shows promise for the evaluation of quality for processing in breeding and inspection.

3349 RICHARDSON, D. L.
Pericarp thickness in popcorn.
Agron. J. 1960 : **52** : 77–80.

A method of measuring pericarp thickness in sections from unpopped grains was devised, by which the influence of the following factors was minimized: position of the hull relative to the rest of the grain, position of the kernel on the ear and stage of maturity at harvesting. Diverse types of maize showed a wide range of variation in pericarp thickness. Among both dent and popcorn, thick and thin pericarp lines were recognizable. Analysis of five popcorn inbreds of diverse origin and their F_1 progeny in all possible combinations indicated that a single major dominant gene determined thin pericarp and a modifier complex thick pericarp.

3350 UDO, S. & IKEDA, N.
(Studies on wild mint in the prefecture of Okayama and neighbouring regions. I. On a clone collected in the outskirts of the city of Hukuyama and the artificially induced tetraploid from it).
Okayama Daigaku Nogakubu Gakujutsu Hokoku/Sci. Rep. Fac. Agric. Okayama Univ. 1959 : No. 13 : 17–25. [Japanese].

This sterile clone appears to be a hybrid between cultivated Japanese mint and *Mentha spicata*. It has $2n = 72$ chromosomes, but in contrast to artificial hybrids between these species [cf. XXVI, 2968 and XXVII, 3610], the modal meiotic configuration is $3_{IV} + 6_{II} + 48_{I}$. In the colchicine-induced tetraploid, the modal meiotic configuration is $6_{IV} + 12_{III} + 36_{II} + 12_{I}$; the reason for the high frequency of trivalents is obscure.

3351 SHARMA, A. K. & BHATTACHARYYA, N. K.
Cytological studies on different species of *Mentha* with special reference to the occurrence of chromosomal biotypes.
Cytologia, Tokyo 1959 : **24** : 198–212.

The following chromosome numbers were found: (1) *M. viridis* 'I', $2n = 32$; (2) *M. viridis* 'II', $2n = 48$; (3) *M. piperita* 'I', $2n = 72$; (4) *M. piperita* 'II', $n = 66$; and (5) *M. arvensis*, $2n = 90$. The caryotype was analysed in (1), (2), (3) and (5) and meiosis was studied in (1) and (4). Each species and variety had a characteristic caryotype; a considerable degree of structural changes in the chromosomes has therefore occurred during evolution. As shown by the investigations of the authors and other workers, polyploidy has played an important

part in speciation. Six chromosomes is considered to be the possible basic number of the genus, from which all the euploid and aneuploid representatives have been derived. Attention is drawn to the large number of chromosomal biotypes and their possible significance from the standpoint of cytoecology. Variation in chromosome number in the same somatic tissue and the predominance of the vegetative mode of reproduction are thought to be responsible for the origin of the chromosomal biotypes or individuals with deviating chromosome numbers. Somatic variation in chromosome number may also be regarded as a factor influencing speciation.

3352 DANERT, S.
Zur Gliederung von *Petroselinum crispum* (Mill.) Nym. [**The classification of *P. crispum* (Mill.) Nym.**].
Kulturpflanze, Berlin 1959 : **7** : 73–81.

P. crispum is said to be the correct name for garden parsley. Four varieties are distinguished within convar. *crispum*, two of the varieties being further subdivided. In convar. *radicosum*, two varieties are named, *radicosum*, with two forms, and *erfurtense*; the latter is a new variety.

ECONOMIC LOWER PLANTS

3353 ŠAHSUVARJAN, A. V.
(The fermenting of Sherry wines by Uzbek strains of yeasts).
Vinodelie Vinogradarstvo SSR (Winemak. & Vitic. USSR) 1959 : No. 7 : 14–16. [Russian].

Among active strains selected in Uzbekistan for fermenting Sherry types of wine were strains 12, 18, 84 and 134, which are tolerant of 15%–16% alcohol. All these produced larger amounts of aldehydes than the Spanish strains 96K and 20S and the Armenian strain 53H after 30 days.

3354 LUZZATI, M., CLAVILIER, L. & SLONIMSKI, P. P.
Inhibition par l'histidine de la réversion prototrophe chez la levure diploïde hétéroallélique pour le locus adénine-histidine. (**Inhibition by histidine of prototroph reversion in a diploid yeast heteroallelic for the adenine-histidine locus**).
CR Acad. Sci., Paris 1959 : **249** : 1412–14.

In this study of mutants of *Saccharomyces cerevisiae* (ad_3) which require adenine and histidine for growth, heteroallelic diploids between two ad_3 mutants of different origin were used, which, as a result of nonreciprocal recombination at the ad_3 locus, frequently give rise to prototrophic reversions. On minimal media the rate of prototrophic reversion was 10^{-4}/cell/day, without apparent cell multiplication. The rate decreased in the absence of glucose and with other treatments with an adverse effect on metabolism. The addition of traces of adenine sufficient to cause two or three residual divisions in the auxotrophic cells resulted in a rapid increase in rate, while the addition of histidine, in amounts sufficient to induce appreciable growth in the auxotrophs, caused a marked decrease in reversion rate. Other experiments showed that histidine does not inhibit the growth or the phenotypic expression of the reversed clones and that interpretations based on a selection mechanism could be eliminated. It is thought that histidine either inhibits the recombination leading to the reconstitution of the allele ad_3^+ or inhibits the expression of ad_3^+ when this allele occurs in cytoplasm formed in the presence of ad_3^- but does not inhibit its expression in ad_3^+ cytoplasm.

3355 ROBERTS, C., GANESAN, A. T. & HAUPT, W.
Genetics of melibiose fermentation in *Saccharomyces italicus* var. *melibiosi*.
Heredity 1959 : **13** : 499–517.

A strain of *S. italicus* var. *melibiosi* isolated from the digestive tract of man contained at least three independent polymeric genes (Me_1, Me_2, Me_3) for melibiase synthesis and a strain isolated from the digestive tract of the horse at least six independent polymeric genes (Me_4–Me_9) for this capacity. Whether any of the *Me* genes in the two strains were identical was not determined. The process of raffinose hydrolysis in the absence of *R* genes for the synthesis of β-h-fructosidase is similar in *S. italicus* var. *melibiosi* and *S. carlsbergensis*. No evidence of polymeric genes for galactose fermentation was obtained from either strain, but probably the strain from the horse carries more than one gene for maltase synthesis.

3356 DESBOROUGH, S. & LINDEGREN, G.
Chromosome mapping of linkage data from *Saccharomyces* by tetrad analysis.
Genetica 1959 : **30** : 346–83.

Details are given of the application of the method of tetrad analysis in the mapping of 13 genes and of the assumptions underlying the method. Chromosome I in the Lindegren breeding stock of *Saccharomyces* carries eight genes in the order *ur*-centromere-*ca–ch–ni–hi–is–an–co*; *th* appears to be on a chromosome

arm separate from the *ch* or *ur* arm of I, while the remaining four genes, α, *ad*, *ga* and *cu*, were identified as centromere markers separate from the three arms carrying *ch*, *th* and *ur* [cf. XXIX, 3292]. The pattern of centromere segregation varied radically from family to family. Preferential segregation was of common occurrence in this stock. The manner in which crossing over took place was also specific for each family, the average number of cross overs, the distribution of the number of exchanges within a particular region and the distribution of the four types of double exchanges being family specific. Frequency of crossing over per unit of "real" length is greater in *Saccharomyces* than in any other organisms so far studied.

3357 Oppenoorth, W. F. F. & Friends, F. H. M.
Kunstmatige bastaarden van gist door middel van DNZ (II). (**Artificial yeast hybrids produced by means of DNA. II**).
Vakbl. Biol. 1959 : **39** : 221–26.

DNA from *Saccharomyces chevalieri* strain W_{332}, which is able to ferment raffinose and sucrose but not melibiose, was able to transform the yeast $K_{83}S_{58}$, which bears the reverse characters; the three characters were independently transmitted. Segregation ratios in asci of the transformed cultures, in crosses between the different transformed cultures and in crosses of the transformed cultures with the original acceptor strain showed that the ability to ferment each sugar was dominant and monogenically controlled.
The ability to ferment maltose was transmitted to the recessive yeast $K_{83}S_{58}$ by means of DNA from beer yeast, and one of the transformed cells proved homozygous for this character. Intergeneric transformation was also effected, the ability to ferment glucose and sucrose being transferred from *S. chevalieri* to *Pichia membranifaciens*. It is concluded from the experiments that transforming DNA becomes localized exclusively in the nucleus and that it is not specific as regards either species or genus.

3358 Laskowski, W., Brustad, T. & Stein, W.
Strahlenempfindlichkeit von homozygoten Hefezellen verschiedenen Ploidiegrades gegenüber dicht ionisierenden Korpuskularstrahlen. (**The susceptibility of homozygous yeast cells of different grades of ploidy to densely ionizing corpuscular rays**).
Naturwissenschaften 1959 : **46** : p. 498.

Four strains with the genotypes α, αα, ααa and αααa were treated with various doses of irradiation from four different radioactive isotopes. For all types of irradiation, the triploid strain was the most resistant and the tetraploid was considerably more susceptible than the diploid; the relatively greater resistance of the diploid as compared with the haploid decreased with increasing LET values. A mathematical analysis of the results showed that the greater susceptibility of the tetraploid as compared with the triploid was the result of dominant lethal mutations occurring in the tetraploid.

3359 Moat, A. G., Peters, N. (Jun.) & Srb, A. M.
Selection and isolation of auxotrophic yeast mutants with the aid of antibiotics.
J. Bact. 1959 : **77** : 673–77.

Using an adenine-requiring mutant of *Saccharomyces cerevisiae* distinguishable by its pink pigment, a method was developed for assessing the ability of antifungal agents to eliminate wild type cells from a mixed population of mutants and prototrophs. Amphotericin B, endomycin and nystatin showed a high degree of selective action. However, respiratory-deficient mutants survived exposure to these antibiotics and this method is therefore most applicable to strains which do not produce respiratory mutants at a high frequency.

3360 Seliverstova, L. A.
(**The effect of γ-rays from Co^{60} upon riboflavin synthesis by yeasts**).
Izv. Akad. Nauk SSSR (News Acad. Sci. USSR) : Ser. Biol. 1959 : No. 3 : 412–17. [Russian].

The amount of free and bound riboflavin in early generations of *Torulopsis* and *Candida* which had been irradiated with 60 and 100 Kr. has greatly increased. Early cell generations of *Saccharomyces cerevisiae* given the same treatments showed a reduction in the synthesis of riboflavin when cultured in a nutrient solution of sugar and minerals, but an increase of 6–20% by comparison with nonirradiated yeast cells when cultured upon an agar medium.

3361 Pittman, D.
Ultraviolet induction of respiration-deficient variants of Saccharomyces and their stability during vegetative growth.
Cytologia, Tokyo 1959 : **24** : 315–25.

Respiration-deficient colonies arising after ultraviolet treatment of both haploid and tetraploid yeasts were classifiable into whole-colony and sectored types, but only when the plates were

overlaid with triphenyl tetrazolium chloride agar. Some cases of apparent reversion to the wild type may be explained on the basis of the heterogeneity in the respiratory phenotype in sectored colonies. Whole-colony variants could be grouped into two classes, one similar to spontaneous variants and failing to revert to the wild type, and the other generally undergoing reversion at a low frequency. The first type occurred the more frequently and presumably resulted from nongenic damage, while the second type was genic in origin.

3362 Potec, I., Potec, E., Şeptilici, G. & Butănescu, G.
Comportarea unor rase de drojdii pe material—must omogen. (**The action of some yeast races on a homogeneous must**).
Lucrăr. şti. Inst. agron. Ion Ionescu de la Brad Iaşi 1959 : 355–63.

The wine-making capacities of a series of 12 Rumanian and introduced wine yeasts were ascertained. The Steinberg and Épernay races were best.

BOOK REVIEWS

3363 Müntzing, A.
Ärftlighetsforskning. En översikt av metoder och huvudresultat. (**Genetical research. A survey of methods and the main results**).
LTs Förlag, Stockholm 1960 : 2nd Ed. : bound 28 Kr. : unbound 23 Kr. : Pp. 327 : 213 figs.

Professor Müntzing's book was first published in 1953 [cf. XXV, p. 100] and two years ago appeared in a German edition [cf. XXVIII, 2416]. This new Swedish edition retains the changes introduced in the German version, noted in our review of that book, and shows the same improvement in the photographic reproductions. Otherwise, the chief difference between the present and the first edition lies in the incorporation of new material on biochemical genetics, the genetics of bacteria, phages and viruses, complex loci, the structure of genetic material, the human blood groups and cancer research. The list of references follows the same arrangement as in the German edition, but is longer and includes more English and Scandinavian works and fewer German.

3364 Malinowski, E.
Genetyka. (**Genetics**).
Państwowe Wydawnictwo Naukowe, Warszawa 1958 : zl. 42 : Pp. 582 : 331 figs. : 47 tables : 14 plates.

Beginning with the evolutionary theories of Darwin, Wallace and others, this textbook of genetics outlines the concepts of the classical theory of inheritance. The reader is introduced to the work of Johannsen on pure lines and of Bateson, de Vries and Baur on mutations before being presented with an explanation of the Mendelian laws. The basic work of the early Mendelists is outlined, many of the original illustrations being reproduced; the phenomena covered include segregation of multiple genes, modifying and lethal factors, the influence of environmental factors on gene expression and effect of various factors that may lead to deviations from the expected Mendelian ratios. The role of the chromosomes as the material basis of heredity is then explained, largely on the basis of the work on *Drosophila*, maize and tomatoes, and this is followed by a special chapter on mutations, which includes, in addition to the classical cases, reference to a number of vegetative mutants and to biochemical mutants in *Neurospora* and bacteria; chromosome mutants are considered in a separate chapter, in which the effects on the phenotype of various chromosomal aberrations are considered; a further chapter entitled "genome mutations" deals with polyploidy, reference being made to the best known cases of allopolyploidy and amphidiploidy, and to aneuploids. The role of chromosome aberrations and polyploidy in evolution is considered in a later chapter devoted to evolution. The inheritance of sex is considered separately in animals and plants. Inheritance in man is dealt with on conventional lines, with references to the pedigrees of musical families and to identical twins. A chapter on the nature of the gene includes a reference to the Watson-Crick model for DNA. *Dauermodifikationen* are considered under cytoplasmic inheritance.

The chapter on evolution contains a brief section on Lamarck and the inheritance of acquired characters; experiments of MacDougall, Harrison and others are shown to be susceptible of explanation as selection effects and the cautious conclusion is reached that there is no evidence so far that can be accepted as definite proof of the inheritance of acquired characters. There is no mention of the work of T. D. Lysenko and his school.

A chapter on the practical application of genetics in agriculture includes details of the production of some of the best known Polish

cultivars such as the wheat Dańkowska Granatka from crosses of English Squarehead with the Polish wheat Puławka; the hybrids produced are said to have formed the basis for the main achievements of wheat breeding in Poland. The successful use of wide crossing by Mičurin in breeding fruit trees is also mentioned. The use of heterosis is illustrated by the production of hybrid corn and hybrid onions. Other methods of improvement referred to include the induction of mutations and of polyploids, mention being made of tetraploid serradella and red clovers produced in Poland by T. Łączyńska-Huleviczowa; the former give 100% and the latter 10–30% increases in yield of forage, though both are inferior in seed yield; the tetraploids have a wider range of variation and offer greater possibilities for selection. The successful use of artificial polyploids in other countries such as Sweden is also mentioned.

3365 FALCONER, D. S.
Introduction to quantitative genetics.
Oliver & Boyd, Edinburgh & London 1960 : 35s. : Pp. ix + 365 : figs. : tables.

It is generally felt that mathematical genetics constitutes an elegant and self-consistent theoretical system, and though its principal exponents differ somewhat in their choice of symbols, they largely agree in their initial postulates and consequently in the mathematical inferences derivable from them. Trouble enters when attempts are made to relate the general theory to concrete genetic situations, either by way of interpretation of results or by forecasting what will occur. Here success has been only sporadic. The Unit of Animal Genetics of the Agricultural Research Council at Edinburgh has long been to the forefront in attempting to apply mathematical genetics to animal breeding and a considerable proportion of the much-needed tests of the theory have come from this unit. Consequently, a general exposition of the theory and applications of quantitative genetics, at not too high a mathematical level, by a member of this unit, is most welcome, especially as the author combines his grasp of the subject with an unusual capacity for clear exposition.

The basic postulates of population genetics are treated in the first five chapters of the book, the first dealing with the attributes of large panmictic populations, leading up to the Hardy-Weinberg equilibrium, the second with the effects of migration, mutation and selection, and the next three with the genetic phenomena peculiar to small populations.

The treatment of quantitative characters is described in the next five chapters, which deal in turn with continuous variation, phenotypic and genotypic values, population mean, breeding value (additive genotype) and dominance deviation, the components of variance, the resemblance between relatives, and heritability.

Three chapters are devoted to artificial selection and include an interesting discussion on asymmetrical response. These are followed by three on inbreeding and crossing, which include discussions on overdominance, heterosis and combining ability.

Lastly, four rather miscellaneous chapters deal with scale transformation, threshold characters and Waddington's concept of genetic assimilation, correlation between characters, and natural selection and fitness. A useful glossary of symbols is appended.

The level of exposition is such as to acquaint the reader with the general theory involved and consequently the book does not include directions how to compute genetic parameters from experimental data. On the other hand, extensive use is made of experimental data to illustrate the various points. Botanists will be conscious of the author's zoological preoccupations. Only diploid organisms are considered and the author, in spite of occasional reservations, seems instinctively to regard self fertilization as abnormal and deleterious.

Of particular value is the frankness with which the author discusses the difficulties encountered in applying the general theory to special cases. Thus, on p. 83, the difficulties of interpreting the greater interpopulational variance of small populations as compared with large populations are set out. On pp. 133–34, some of the problems resulting from genotype-environment interactions are considered, on pp. 212–15, the poor accord between theory and fact in measuring progress during selection is pointed out, and on p. 286, the disparity between theory and achievement in selection for special combining ability is recorded.

The ill accord between theory and fact presumably results from inadequacies in the set of primary postulates and a discussion of these by the author would have been most interesting. However, this would probably have taken the author beyond the limits of exposition within which he has so successfully presented this introductory account.

3366 WALLACE, B. & DOBZHANSKY, T.
Radiation, genes, and man.
Henry Holt and Company, New York 1959 : $3.50 : Pp. xii + 205 : 19 figs. : 5 tables.

In order to make the subject intelligible to the

general reader this book on the hazards of atomic radiation begins with a simplified account of the principles of Mendelian genetics, special attention being given to the question of mutation and chromosome aberrations. The positive and negative sides of mutation are carefully examined and a list is even given of some of the useful mutations that have been produced in crop plants by exposure to high-energy radiations. A general account is given of the nature of these various radiations, of their origin and of their effects. Data are cited showing that the man-made radiation to which organisms are exposed in technologically advanced countries is about twice as great as the permanent background radiation that is always present in this planet. Though not regarded as unduly alarming, this increase is considered to be sufficiently serious to call for special precautions: one of those recommended is the discontinuance of the use of X rays for fitting shoes.

The action of radiation in increasing the mutation rate is explained. The information is conflicting, we find, on the very crucial question as to whether a given dose of irradiation is equally effective when given in a chronic form over a prolonged period as when applied in an acute form. The authors nevertheless take the view that the effects are cumulative. We are also told that the target theory is an oversimplification and that irradiation results in the production of highly reactive, short-lived chemical substances in the cells and chromosomes; hence the search for an antimutagen is not altogether fruitless.

The general principles of population genetics are outlined. Studies of the wild populatons of *Drosophila pseudobscura* have shown that "a fly which is free of deleterious genes of all sorts —lethals, viability modifiers, sterility factors, and the rest—will be found only rarely, if ever". For human populations it is calculated that there may be as many as 5 lethals on the average per human sex cell, or some 10 concealed recessive lethals per individual, though this estimate is subject to a number of reservations. It is further calculated that the permissible level of exposure to radiation, as given by the Genetics Committee of the US National Academy of Sciences, would lead to an increase of some 10% in the frequency of hereditary ills when the population had reached equilibrium; and again, with an assumed total world population of 3 billion, exposure for 10 years only would lead to "the genetic death of 3 million persons per generation for all mankind". Complications are however introduced by the possibility of heterosis in heterozygotes for lethal or sublethal genes and evidence is adduced for the belief that this occurs more frequently than many geneticists have imagined. In fact it is frankly stated that the answer to the questions discussed in the book will only be forthcoming after the completion of much further research on genetics, which, it is added, will in time "be recognized as no less important than research on various ballistic missiles". The points that emerge most clearly are that mankind has a "genetic load"; that the use and misuse of radiation have magnified but not created the problem posed by this genetic load; and that "one wishes, surely, that this load might be lightened, not made heavier as it seems destined to be."

3367 Darlington, C. D. & La Cour, L. F.
The handling of chromosomes.
George Allen & Unwin Ltd., London 1960 : 3rd Ed. : 30s. : Pp. 248 : 7 figs. : 12 tables : 24 plates.

First published in 1942 [cf. XII, p. 202], next in a revised edition in 1947, this book now appears in a much expanded version with 248 pages, compared with 165 in the first edition and 180 in the second. Most of the 12 original chapters have received some additions. Thus in chapter 7 nine basic dyes for aqueous staining are described instead of five, chapter 8 has been extended to give more details of microchemical tests for proteins, nucleic acids and phospholipids as well as a section on lampbrush chromosomes, and in chapter 9 the section on mutagenic radiations and chemical agents has grown from about 5 pages in the second edition to over 13 in this. Further additions include a chapter on autoradiography, a number of new photographic plates, several detailed schedules of treatment and many additional references.

3368 Schussnig, B.
Handbuch der Protophytenkunde. (**Handbook of the Protophyta**).
Gustav Fischer Verlag, Jena 1960 : Vol. II : DM 137.50 : Pp. x + 1144 : 880 figs.

The second volume, promised at the time of publication of the first [cf. XXIII, p. 657], is devoted to cell morphology. Each chapter deals historically with a particular set of structures and functions, the first being concerned with the locomotive apparatus, a variety of types of flagellum and similar organs being described. Next come chapters on chondriosomes and related structures, on plastids, on vacuoles, on

alloplasmatic structures and substances and on cell walls and other membranes. There follows a series of chapters on morphogenesis and cell reproduction, sexual and asexual, in the different groups, illustrating the fantastic versatility of these so-called lower orders, which include many organisms familiar to agriculturalists as pathogenic fungi but a great many more besides. Certain questions of homology are also considered.

The second volume maintains the standard of excellence commented on in the first.

3369 HARRISON, S. G.
Garden shrubs and trees.
Eyre & Spottiswoode, Ltd., London 1960 : 25s. : Pp. 318 : 73 figs. : 15 plates.
TAYLOR, P. G.
British ferns and mosses.
Ibid. 1960 : 25s. : Pp. 231 : 52 figs. : 15 plates.

The aim of the Kew Series, two volumes of which have already appeared [cf. XXIX, 913], is to provide the interested layman with a guide to the native, naturalized and cultivated plants of the British Isles which is not only attractively illustrated and readable but also authoritative and accurate enough to serve as a basis for more advanced botanical studies. The plan of each book is similar: an introduction outlining the structure and taxonomy of the group of plants under consideration is followed by an identification key and individual plant descriptions arranged according to family; each volume further contains 15 colour plates and numerous text illustrations.

Mr. S. G. Harrison's Garden shrubs and trees will probably be received with pleasure by gardeners who like to know something of the botany of their plants. Nearly all the more commonly grown species are mentioned and also some which the author regards as worthy of greater popularity than they at present enjoy. The salient features in the appearance of each plant are described, its country of origin is mentioned and notes on its hardiness and soil requirements are sometimes included. Miss A. V. Webster's colour plates and Mr. E. Petts's line drawings are extremely good.

The numerous handbooks on ferns published in the last century and the relatively few modern books testify to a decline in interest in this group of plants. Mr. Taylor's book aims at reviving the popularity of ferns and their allies, and he may well succeed, for with its full descriptions and large, clear drawings and colour plates it is probably the best and certainly the most attractive book on the ferns to have appeared in recent years. A short section of the book is devoted to some of the most common and conspicuous British mosses; these are illustrated and described, but no key is provided. Most of the illustrations, all by Miss Webster, are good, but that of *Ceterach officinarum*, showing a well-developed indusium instead of the rudimentary one described in the text, leaves something to be desired, and some of the drawings of mosses are extremely sketchy without really showing the characteristic appearance of the plants. Green is of course a notoriously difficult colour to reproduce, and the subtle differences in shade between fern species have not been caught; and among the mosses the distinctive whitish colour of *Plagiothecium undulatum* and the translucency of *Hookeria lucens* have also proved elusive. Nevertheless, the general effect is pleasing and the volume may be recommended as a useful introduction and guide to British ferns, horsetails, club mosses and mosses.

3370 Flore du Congo Belge et du Ruanda-Urundi. Spermatophytes. (**Flora of the Belgian Congo and Ruanda-Urundi. Spermatophytes**).
Institut National pour l'Étude Agronomique du Congo Belge, Bruxelles 1960 : 9 : Pp. 597 : 1 map : 14 figs. : 56 plates.

The last volume of this major contribution to African floristics to be reviewed was Volume VII, issued in 1958 [cf. XXVIII, 4938]. The present volume, arranged similarly to its precursors, deals with the following families: Buxaceae, by W. Robyns; Anacardiaceae, van de Veken; Aquifoliaceae, A. Robyns; Celastraceae and Hippocrateaceae, R. Wilczek; Salvadoraceae, W. Robyns; Icacinaceae, R. Boutique; Sapindaceae, L. Hauman; Melianthaceae, L. Toussaint; Balsaminaceae, R. Wilczek and G. M. Schulz; Rhamnaceae, C. Evrard; Vitaceae, J. Dewit and L. Willems; and Leeaceae, a recent split from the preceding family, J. Dewit.

3371 HAENSCH, G. & HABERKAMP, G.
Dictionary of agriculture. German, English, French and Spanish. Systematical and alphabetical.
Crosby Lockwood & Son, Ltd., London 1959 : 85s. : Pp. xxiv + 649.

This four-language dictionary of agriculture was compiled with the assistance of numerous experts in different countries and the result of this care can be detected in the relative accuracy with which most of the equivalents are given in the respective tongues. The German *Standort*

for instance, invariably a source of embarrassment to conscientious translators, is given four English equivalents: site, habitat, locality, station. A choice of equivalents to fit different contexts is given in a great number of cases and in the English-language section alternatives for British and US usage are frequently provided. The entries, some 35,000 in number, are arranged in 13 main groups, one for general terms and others comprising research and information, administration and legislation, economics, processing, soil science, crop husbandry, horticulture, genetics, animal breeding, farm buildings, and machinery. They appear in the order of the German words but separate keys are given for the English, French and Spanish terms, thus making for ease of reference; it is unfortunate however that in compiling these keys combined expressions have been placed only under the first word of the expression, so that such things as oats and dandelion appear, for instance, under common oats and common dandelion but not under oats or dandelion, knapweed under brown-rayed knapweed and so on.

In a work as all-embracing as this it is not possible to cover all fields completely and some geneticists may find the choice of terms somewhat arbitrary; the same applies to diseases and other sections too. There are a number of misprints: *Pominanz* for *Dominanz*, bam for barn, persistant for persistent, heridity for heredity, see for sea and so on. Certain omissions strike one, as for example *fitotecnia* as a Spanish (or at least South American) equivalent for plant breeding; and of course cultivar has not yet penetrated as an equivalent of German *Sorte*. There are even some positive inaccuracies, such as barrel for *Bauch* and runner bean for *Stangenbohne*, and improper equivalents such as sunn crotalaria instead of sunn hemp. There are several instances, such as *Beta* and *Brassica*, or *Phoma betae* and *Pythium de Baryanum*, which are given only a single equivalent in both French and Spanish. Implied distinctions such as that between rape and rapeseed are mystifying, and many of the entries for diseases carry incorrect implications of a limitation to particular plants. These defects, however, add up to a relatively small amount in comparison with the number of correct entries.

3372 Bryson, V. (Editor).
Microbiology yesterday and today.
Institute of Microbiology, Rutgers 1959 : $4.00 : Pp. v + 122 : figs. : tables.

A symposium was held at the Institute of Microbiology of Rutgers University on 5 June, 1958, in honour of S. A. Waksman and the proceedings are published in this volume. The first contribution was on Microbial biochemistry and its development, by H. J. Quastel, who traced the developments since the discovery of enzymes by Buchner at the turn of the century, giving a bibliography of 121 references. The next contribution was on Antibiotics—a new field for microbiological research and perspectives for the future, by H. B. Woodruff, who pointed to some of the biochemical differences that are being detected between microbial cells and those of the host organisms, differences which provide the possibilities for further advance in antibiotic research; antibiotics that have been found effective against certain virus infections of both animals and plants are referred to; studies of the biosynthetic pathways of certain antibiotics have led to unexpected discoveries and more are expected if further leads are pursued, several cases of controlled biosynthesis of new antibiotics being mentioned. M. Heidelberger spoke on Episodes in immunochemistry and S. T. Cowan on Bacterial classification—problems and developments. This author adopts the view that the bacteria represent precursors of both plants and animals and various features used in attempts to classify them are considered. In the Enterobacteriaceae, we are told, "antigenic chaos is giving place to a rationalism based on the fundamental enzymic nature of the bacterial cell instead of on its outer cover"; the view is expressed that the success of modern taxonomic methods depends on being able to analyse a large number of diverse results, and this nearly always involves electronic sorting. In discussing the species problem, evidence in favour of the fixity of species is presented, such changes as the development of drug resistance not being regarded as affecting the taxonomic position of an organism; changes induced by transforming principle or bacteriophages are also regarded as largely superficial; yet existing species are shown to be centres, around each of which are gathered strains showing divergent characters, the areas of certain related species being found to overlap. Something better than this is called for and it it suggested that "taxonomy must be simplified because the results of every type of investigation, be it morphological, serological, physiological, or genetic, are shouting out to us that our finer divisions are nonsense, and that we are making taxonomic fools of ourselves".

V. Bryson spoke on Some contributions of genetics to microbiology, which is considered to

be one of the most significant developments in the recent history of both sciences. Some of the outstanding contributions to the subject are named. The evolutionary selection of spontaneous mutants is said to be "beautifully exemplified by the changing bacterial flora which has accompanied the rise of antibiotics" and we are told of a strain of *Salmonella* resistant to chlortetracycline, oxytetracycline, chloramphenicol and streptomycin being transmitted by staff *and* a shrew mouse in a children's hospital. In summing up the contributions made respectively by geneticists and microbiologists the view is expressed that the lack of formal knowledge of genetics on the part of many microbiologists has been an advantage, whereas the microbial geneticists are criticized for not educating themselves as microbiologists. Aspects of Russian microbiology are treated by G. K. Skriabin, who referred to the work of Mečnikov, Vinogradskij, Kostyčev, Ivanov, Ivanovskij and Voronin, gave statistics of the number of research centres in Soviet Russia and referred to the induction of mutations in *Mucor genevensis* and *Zygorhynchus moelleri* by X-ray treatment in 1925. In later work certain positive mutants have been obtained, including yeasts superior in vigour, strains of *Aspergillus* producing greater quantities of citric acid and *Azotobacter* strains with increased capacities for nitrogen fixation. Systems of phylogenetic classification have been elaborated for a number of organisms and other developments include the selection of soil microorganisms for improving soil fertility and the production of antibiotics active against viruses and neoplasms. The final contribution is by S. W. Waksman himself, who pointed to some of the contributions that the microbiologists of yesterday made to pathology, industrial and organic chemistry, physiology and biochemistry. Characteristic of today's microbiologists are the genetic approach and greater concern with metabolic pathways, enzyme systems and host-parasite relationships. A warning note is sounded, lest the microbiologist of tomorrow should forget that he is working with an organism and should overlook the need for training in botany, zoology, medicine or agriculture.

3373 Horsfall, J. G. & Dimond, A. E. (Editors).
Plant pathology: an advanced treatise. Vol. II: the pathogen.
Academic Press, New York and London 1960 : $22.00 : Pp. xiv + 715 : figs. : tables.

The second volume [cf. 2147], devoted to the pathogen, begins with an essay on the concept of causality in pathogenesis, contributed by the editors. The next essay is The nature, origin, and evolution of parasitism, by G. L. McNew, and contains a section on the host genetics in relation to type of pathogenicity. It is pointed out that the inheritance of resistance seems to vary with the degree of specialization involved in the parasitic processes. Thus rots of storage organs and decays of food reserves are difficult to control by resistant varieties, and so are root rots and seedling diseases, all these diseases being largely lacking in specialization. Attacks by vascular parasites are more readily controlled; the organisms causing them are not prone to develop physiological races and inheritance is usually governed by a small number of genes. Under the heading downy mildews, reference is made to the repeated failures to breed a potato resistant to *Phytophthora infestans* owing to the ability of the fungus to produce new parasitic races; for the highly specialized powdery mildews and rusts the breeding of resistant varieties is said to be a relatively simple matter, only equalled in simplicity in fact by the power of the parasite to reorganize its own genes; and to the question as to how many diseases have been totally eliminated by breeding or, indeed other control measures, the answer given is "Not one!" A relatively favourable host-parasite balance seems to be the most that can be aimed at.

F. C. Bawden writes on The multiplication of viruses. The dozen or so viruses that have been sufficiently analysed have all proved to consist exclusively of protein and nucleic acid, in proportions that differ in different viruses; the proportions of the aminoacids may also differ in unrelated strains though between closely related strains no such differences can usually be detected; spatial arrangement of the nucleotides within the nucleic acid may account for strain differences. By analogy with the bacteriophages it is suggested that the protein component of plant viruses may be responsible for its penetration of the cell. There is reason to believe that these viruses undergo some change analogous to the separation of the protein and nucleic acid that occurs in T2 bacteriophage; there is, however, no evidence to suggest whether this event happens as a preliminary to plant viruses entering their host cells or when they have entered and met some specific cell constituent. The story as familiar from the bacteriophage is however described. Reference is made to evidence that, when different strains of tomato spotted wilt virus are multiplying

together in the same plants, progeny are produced that combine characters from the different strains, it being suggested that such changes may often have been mistaken for mutations. The various environmental and other factors that affect virus susceptibility in the host suggest "that success or failure in establishing infection depends on whether or not the nucleic acid survives through a seemingly hazardous period between inoculation and reaching some safe haven". The idea that protection by a nonvirulent strain against infection by a virulent one is due to exchange of genetic determinants is only one of several possible explanations considered.

Reproduction of bacteria, actinomycetes and fungi is reviewed by L. E. Hawker and Spore germination by V. W. Cochrane. After that, S. Dickinson writes on The mechanical ability to breach the host barriers, suggesting that the more complex disease resistance mechanisms may consist of a chain of reactions, partly physical and partly chemical. R. K. S. Wood writes on Chemical ability to breach host barriers; much evidence showing the presence in root and leaf exudates of substances inimical to many microorganisms is analysed but we read with some astonishment that the crucial question as to whether penetration of the cuticle host is aided by chemical action remains undecided, most of the evidence being in favour of purely mechanical penetration. The various types of barrier leading to resistance include the presence of phenols, alkaloids, agglutinating and other substances but not many cases of a direct relationship have been found.

Heterokaryosis, saltation and adaptation are reviewed by E. W. Buxton, who assesses the importance of variability in pathogenic fungi by methods other than sexual recombination and gene mutation. Various ways in which heterocaryons may arise, and some of their advantages, such as heterosis and greater powers of adaptation, are discussed; it is shown how new pathogenic types can arise through parasexual recombination and how this process may play havoc with some of the neat systems established by taxonomists. Many cases of saltation are thought to be the result of heterocaryosis rather than mutation and these too cut across many of the old-established taxonomic systems. The opinion is expressed that, as knowledge increases, most examples of saltation, dissociation and attenuation will ultimately be assigned to some more specific genetic mechanism of microbial variation. The mutation and the enzymatic-adaptation views on adaptation in fungi are outlined; some of the early work is held to have been misleading because of its neglect of biological races but it is shown that for both older and more recent results an explanation based entirely on mutation often fails to explain the speed at which both changes and reversions may occur, and there is at present "more evidence for adaptive change in virulence than there is against it". The definition of "adaptive change" is, however, for the time being kept very general.

We now come to the review on Genetics of pathogenicity, by T. Johnson. An account is given of knowledge on mutation in viruses, bacteria and other asexual pathogenic organisms, a number of cases being cited in which immune or resistant varieties have lost their resistance as a result of mutational changes in the pathogen. Mutation in sexual organisms is exemplified by *Phytophthora infestans* and cereal rusts. The consequences of hybridization and the inheritance of pathogenicity are illustrated by the smut and rust fungi and the Ascomycetes; some data on the inheritance of morphological characters in interspecific and intraspecific crosses are examined, reference being made to the possibility that the false loose smut of barley, *U. nigra*, may have arisen from hybridization between the loose smut, *U. nuda*, and the covered smut, *U. hordei*. The frequency with which segregation leads to increases in virulence or host range is emphasized. Some cases of mutants in which nutritional deficiencies are associated with reduced pathogenicity are also referred to [cf. XXVIII, 3338]. A brief reference is made to the phenomena of transformation and transduction, which have not however been proved to be operative in plant-pathogenic organisms.

Physiology of fungitoxicity is reviewed by H. D. Sisler and C. E. Cox; they include a section on acquired resistance to fungicides and another on mutagenesis and the various cytological disturbances that have been found to arise from treatment with certain toxicants, some of which act directly on the chromosomes, others on the spindle mechanism, and others again on cell division.

There are also chapters on soil microorganisms, toxins, virus inactivation, fungicidal chemistry and nematocides.

3374 Smith, G.
An introduction to industrial mycology.
Edward Arnold Ltd., London 1960 : 5th Ed. : 40s. : Pp. xvi + 399 : 168 figs. : 2 tables.

The fifth edition of this textbook [cf. XXIV,

p. 654] contains descriptions and illustrations of several genera and species not considered in previous editions. Other changes include eight additional photomicrographs, four illustrations replaced by improved versions and one deleted. The bibliographical references now conform to the World list of scientific periodicals. The quality of almost all the illustrations has also, together with the price, been raised.

3375 Steinhaus, E. A. & Smith, R. F. (Editors).
Annual review of entomology. Vol. 5.
Annual Reviews, Inc., Palo Alto, California 1960 : $7.50 : Pp. vii + 451 : figs. : tables.

Again, several topics of interest to breeders and geneticists appear in the fifth volume [cf. XXIX, 3314]. S. G. Smith reviews Cytogenetics of insects. The possession of non-localized centromeres and several other special features make many insects a favourite object of cytological study; it is pointed out that similar aberrant features of chromosome behaviour have been found in forms that are widely separated taxonomically. Ingenious explanations have been suggested for the fact that polyploidy is in some cases accompanied by a doubling of the DNA value whereas there is sometimes a halving and sometimes no change. A. B. da Cunha writes on Chromosomal variation and adaptation in insects, starting with a general consideration of what constitutues progress in evolution. A number of instances where insects heterozygous for some inversion or other anomaly have proved more viable, at least under certain conditions of environment, are cited, though in others no such connexion could be established. Environmental factors to which reactions have been detected include temperature, food, crowding and the genic background. Inversion heterozygotes usually display greater homeostasis. Certain nonrandom associations of inversions have been shown to result from the higher adaptive value given by them when together than when separated. In studies of *Drosophila willistoni* the author and others have demonstrated that the chromosomal variability of the populations is highly correlated with the degree of variability of their environment, a result that has been confirmed also in several other species, though again not in all.

Other contributions deal with the phylogeny of the Coleoptera, evolution and biology of the termites, host selection in phytophagous insects, sampling insect populations and mechanisms of resistance against insecticides.

3376 Kappert, H. & Rudorf, W. (Editors).
Handbuch der Pflanzenzüchtung. (**Manual of plant breeding**).
Paul Parey, Berlin & Hamburg 1959 : 2nd Ed. : Lief. 34 : Vol. 5 : Bogen 6–10 : 81–160; Lief. 35 : Vol. 6 : Bogen 6–10 : 81–160; Lief. 36 : Vol. 6 : Bogen 11–15 : 161–240 : figs. : tables : DM 13.50 each.

Instalment 34 [cf. 951] completes the section on soya-bean breeding in volume 5, dealing with the use of selection, hybridization of different kinds, including interspecific crossing, and induction of mutations. In examining the outstanding results of breeding, mention is made of 20 varieties produced in the USA which are superior in yield, oil content, resistance to lodging, shattering, and some diseases, seed quality and colour, and adaptability to mechanical harvesting, and are specifically adapted in maturity to various production areas. This review contains no reference to any work done elsewhere than in North America, except for one paper from Germany written in English. W. Rudorf writes on Die Sonnenblume, *Helianthus annuus*, L. [The sunflower, *H. annuus* L.]; data are given on its introduction into Europe and its origin, which is now taken to have been in western USA and Canada rather than Peru and Mexico [cf. XXVI, 2734], with a secondary centre of cultigens in Russia. Crossing technique and breeding methods are outlined, data being given on the range of variation encountered in morphological characters and in such properties as content of oil, protein and other constituents, yielding ability and resistance to diseases and pests; tabular data are given showing the yields of some of the lines selected at the Max-Planck Institut für Züchtungsforschung in Germany and particular mention is made of the achievements of sunflower breeding in the USSR [cf. XXVI, 3613]; a final section is devoted to the use and breeding of sunflowers for fodder purposes [cf. XXIX, 2987]. The instalment continues with the first part of the chapter Tabak [Tobacco]; T. H. Goodspeed deals with Systematics of the genus *Nicotiana*, accepting South America as the place of origin, both *N. tabacum* and *N. rustica* having originated there by amphidiploidy. The interrelationships of the species comprising the fourteen sections of the genus and their relationship to *Cestrum* and *Petunia* are elucidated; the Australian species are regarded as having originated by amphidiploidy, probably in Patagonia, and having passed to Australia via Antarctica at a time when the land connexions were more extensive. Anatomy, cytogenetics, biology of flowering and

seed production are next considered. W. D. Valleau writes on Variability and genetics, special methods and general breeding methods, giving an outline of work that has been done on breeding for resistance to mosaic, bacterial wilt, wild fire and angular leaf spot, black shank, black root rot, *Fusarium* yellows, anthracnose, powdery mildew, nematodes and aphids, and for alkaloid content, male sterility and freedom from suckers; the use of male sterility and cold storage of pollen are also considered. Among the results of breeding, special reference is made to the production of varieties possessing combined resistance to three and more of the main diseases. I. Bolsunov writes on Die Tabakzüchtung für europäische Verhältnisse [Tobacco breeding for European conditions], starting with a classification of the main types grown and a tabular list of the European tobaccos considered of interest for breeding purposes.

Instalment 35 continues the section on beetroot in volume 6, factors influencing development and the inheritance of bolting resistance being considered; under biology of flowering, an outline is given of the work of H. and V. F. Savitsky on breeding monogerm sugar-beet varieties, isolation and male sterility being also considered; factors affecting yield and quality are examined, full data being given on the genes governing colour. Breeding methods are described very briefly and the suggestion is put out that the production of hybrid seed might possibly be applied also to garden beet. G. Becker writes on Knollensellerie, *Apium graveolens* L. var. *rapaceum* (Miller) D.C. [Celeriac, *A. graveolens* L. var. *rapaceum* (Miller) DC]; the three forms of celeriac, and blanching and slicing celery are all thought to be derived from *A. graveolens* var. *sylvestre*, which was first used in the wild state, probably in the Mediterranean area, as a simple. Garden celery was first mentioned in Germany around 1700 and how it originated remains uncertain. Though not mentioned in the literature, tetraploids with $2n = 44$ have been produced by the author. Hybrids with *Petroselinum crispum*, which died before flowering, are also described. Details are given of the biology of flowering, technique of pollination, methods of breeding and the various characters for which selection has been performed; these include form and structure of the enlarged root, root yield, colour and flavour, time of maturity, and keeping capacity; the main diseases are enumerated. Today's varieties have been in existence for some time and attempts to improve them by breeding for yield or quality have not so far been successful. Marked differences have been observed by the author in plants of the same variety coming from seed of different provenance, and from the variety Alabaster a new variety, Invictus, with improved form and consistency and white flesh, has been selected. Though tetraploids have been produced by colchicine treatment, they mostly reverted to the diploid condition and those that remained were not satisfactory. A description is given of a scheme of selection based on the selection of lines which, in test crosses run parallel, show the highest combining ability.

The next section of the volume deals with leaf and stem vegetables, the first being Spargel [Asparagus] by J. A. Huyskes and J. Sneep, who consider the species to have arisen in the saline steppes of eastern Europe. Published data on cytology, interspecific crossing, biology of flowering, vegetative propagation and breeding methods are reviewed and a list of the properties for which breeding has been effected includes resistance to cold, rust, foot rot and asparagus fly, colour, consistency and flavour of stem, yield and sex. Special methods of testing for certain characters are outlined and the various breeding methods employed are described. In spite of the wide range of variation that occurs in the existing populations, few if any improved varieties have been released since Mary Washington in 1913. The instalment ends with the first part of Gemüsekohl (*Brassica oleracea* L. [Garden cabbage (*B. oleracea* L.)], by H. Rundfeldt, who starts with a useful outline of the complicated systematics of the genus *Brassica*; descriptions are given of the main types of *B. oleracea* and of the other species, with indications of their various uses, chromosome constitution and probable origins. Though the view that all forms of *B. oleracea* have arisen from *B. oleracea* var. *sylvestris* is regarded as plausible, grounds for believing that the cauliflowers may be derived at least partially from *B. cretica* are mentioned; the kales seem to have originated before the headed types, though forms resembling the Savoy cabbage apparently existed in Roman times. The biological basis of *Brassica* breeding is continued in instalment 36, where vegetative propagation, morphology of flower and fruit, pollination, sterility and fertility and cross and self fertilization are dealt with. The variation that exists in vegetative and reproductive organs is described and details are given of the various crosses that have been produced between different forms. Data are given showing the chemical composition of

different types, their keeping capacity and reaction to pests and diseases; these include various nutritional deficiencies, virus diseases, bacteria, various fungus diseases and a number of insect pests. There is a discussion of the breeding methods and aims in the group as a whole and in each individual member, including the Chinese cabbage. Special attention is given to various systems that enable use to be made of hybrid vigour and two schemes, making use of pollen sterility and self sterility respectively, are described in full, preliminary experiments having shown that pollen sterility can be induced by a 2% solution of sodium 2,3-dichloro-isobutyrate. A brief section on induction of mutations and polyploidy finds few if any promising results to report and the opinion is expressed that with the exception of Chinese cabbage the garden cabbage group is not likely to gain much from autopolyploidy, unless it be in the production of material for further breeding and selection. The instalment ends with the first part of the chapter on Spinat [Spinach], by J. Sneep, who refers to the confusion reigning within the genus *Spinacia*, partly arising from the fact that Linnaeus gave the stamen number five instead of four in his description of *S. oleracea*. On historical grounds the origin of the plant is ascribed to Asia. Data are given on floral biology and range of variation in a number of useful characters, including disease resistance.

3377 STÄHLIN, A.
Die Acker- und Grünlandleguminosen im blütenlosen Zustand. (**Field and herbage legumes in the vegetative state**).
DLG-Verlag, Frankfurt am Main 1960 : DM 8.80 : Pp. 162 : 101 figs.

Forming one of the largest botanical families, the Leguminosae come next to the Gramineae in agricultural importance, and are variously used for human food, animal fodder and soil improvement. Some species are also known as weeds and there are a number of ornamental forms, particularly among trees and shrubs. Since many of the agricultural species are used before they come into flower, it is clearly desirable that they should be identifiable in the vegetative state, and it is as an aid to such necessary identification that the author has written this book. He deals with all the main horticultural and agricultural legumes of central Europe, as well as weeds and noncultivated species growing in agricultural areas; a number of garden trees and shrubs and some of the less common wild species are omitted.

The book has many good points: it has a fairly detailed key to all the species; the vegetative characters of each species are not only clearly described but also illustrated; notes on distribution and uses are included; and it is well printed and conveniently compact. But in a book of this kind a really efficient key is necessary and good illustrations desirable; and in both these respects the present work falls short. The drawings unfortunately are so crude that often the degree of denticulation or hairiness of the leaf, both useful diagnostic characters, cannot be ascertained. And the key, although it does, for example, allow for the reader who is not aware that the apparent stipules of *Lotus* are in fact the basal leaflets, unhelpfully places *Lathyrus* species with two or no leaflets together with those with several in a group described as having pinnate leaves with three or more leaflets. Similarly, *Ulex* can only be run down by the reader who knows that the seedling has trifoliate leaves. However, combined study of the key, the drawings and the description will probably usually lead to correct identification, and for those who find it necessary or satisfying to be able to recognize plants by their vegetative features alone, this book will prove invaluable.

3378 BĂRBAT, I. & PÁLFY, F.
Stadiul de iarovizare și stadiul de lumină la plante. (**The vernalization phase and the light phase in plants**).
Editura Academiei Republicii Populare Romîne 1959 : Lei 5,50 : Pp. 127 : 46 figs.

With the object of applying scientific findings to increasing plant yields in Rumania, the authors have prepared a review of research published in the previous ten years on phasic development, vernalization and photoperiodism. The large majority of papers reviewed are Russian and articles published outside eastern Europe tend to be dealt with via their mention in Soviet publications. The review is divided into two chapters, dealing respectively with vernalization and photoperiodism. Lysenko's hypotheses form the basis of the discussion on the former, while the more concrete theories of Čajlahjan are used to elucidate the latter. The bibliography contains 134 titles.

NEW JOURNALS

Annaly biologii/Annals of biology.

The above journal is being published by the Moscow Society of Naturalists. The subject matter deals with "the history of the most important theoretical problems of biology",

narrowly specialized or purely biographical articles being excluded. The first issue includes a number of articles summarized in this number of *Plant Breeding Abstracts*. English summaries are provided. Further information may be obtained from the Secretariat, Ulica Gercena, Moscow, K–9.

Genetical Research.

The scope of this journal comprises original work on all aspects of genetics or in any field of research with an important bearing on genetics. Each annual volume is to consist of three issues. Dr. E. C. R. Reeve, of the Institute of Animal Genetics, West Mains Road, Edinburgh 9, Scotland, is the executive editor. Subscriptions may be sent to the Cambridge University Press, 200 Euston Road, London, NW1. The subscription price per annum is £5 net. Subscriptions ($17.50) in the USA should be sent to the American Branch of the Press, 32 East 57th Street, New York 22.

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